

FM 55-50

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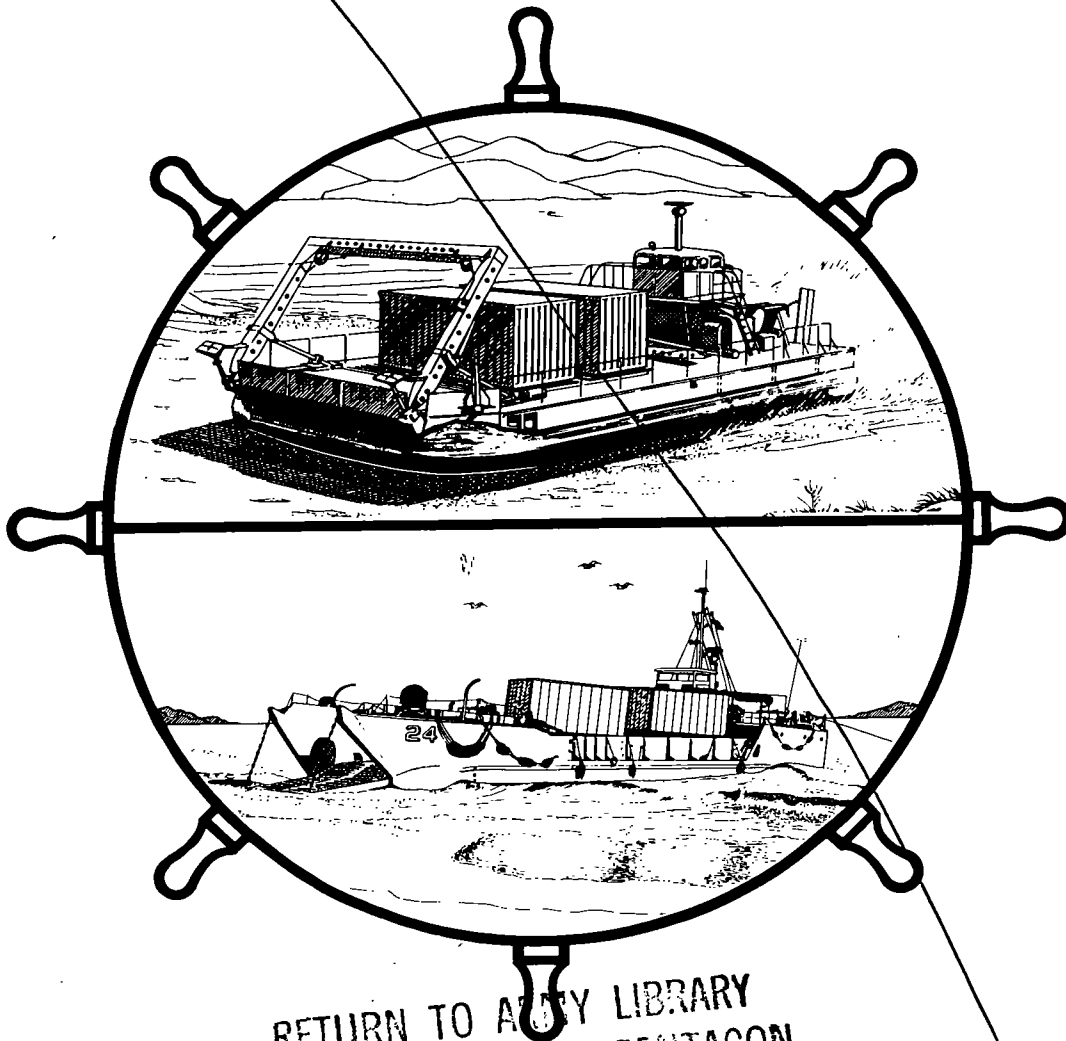
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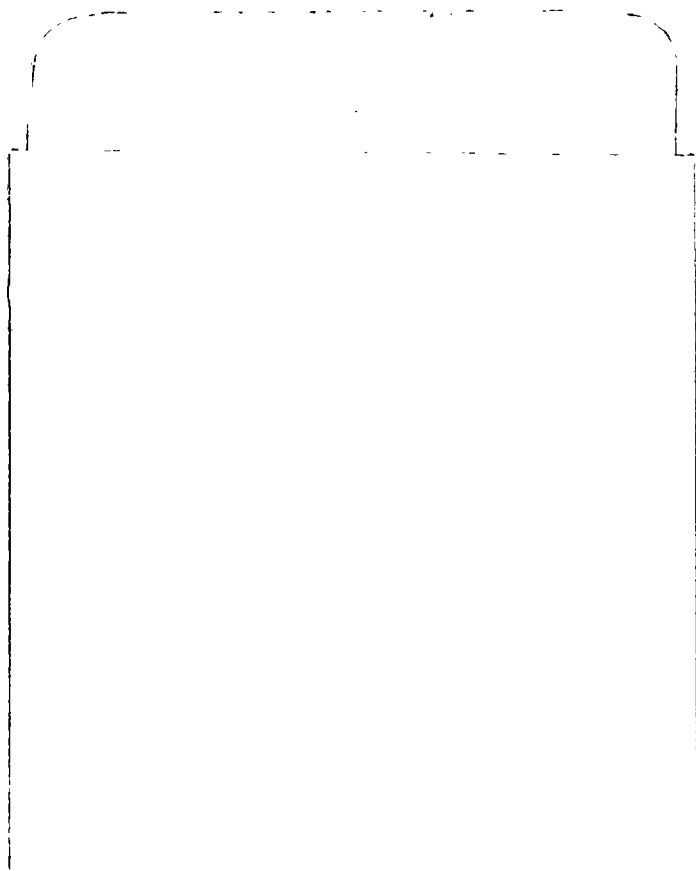
ARMY WATER TRANSPORT OPERATIONS



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No. 55-50 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 September 1976

ARMY WATER TRANSPORT OPERATIONS

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CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

This manual has been prepared to establish basic doctrine for the employment of the Army water transport fleet.

It covers roles, missions, and concepts of employment for individual craft, entire units, and groups of units. The text is written primarily for unit and craft commanders, key supervisory personnel, higher headquarters staffs, theater planners, and commanders of operationally allied units.

The doctrine presented is applicable without modification to general, limited, and cold war.

The words "he," "his," "crewman," and "men" are intended to include both the masculine and the feminine genders. Any exceptions to these intentions will be so noted.

1-2. Recommended Changes

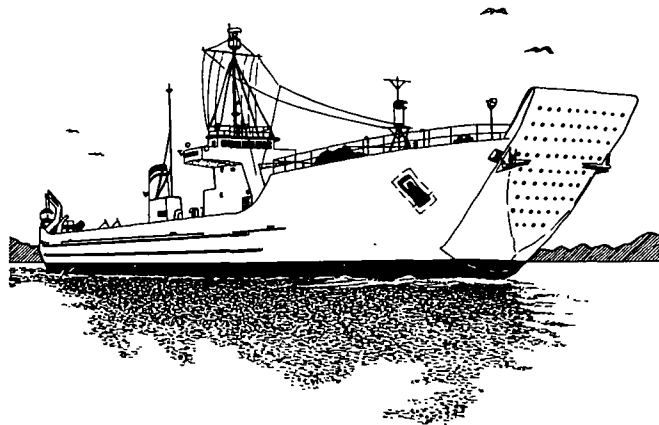
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1-3. Associated Publications

FM 55-50 is the basic manual in a library of Department of the Army marine publications that provide training, planning, and operational guidance for all personnel associated with Army floating craft.

The publications listed below, coupled with this text, the equipment manual issued with each craft, and the various marine book sets, provide a complete reference library for Army water transport operations:

FM 29-39, Marine Equipment Maintenance Support in the Army in the Field covers the mission, assignment, organization, functions, capabilities, and



method of operation of each marine equipment maintenance support unit in the Army.

FM 55-51, Army Water Transport Unit covers the organization, mission, assignment, and capabilities of each Army water transport unit, including detailed duties of individual personnel, functions of organizational elements, and internal unit procedures.

TM 55-500, Marine Equipment Characteristics and Data describes the principal characteristics, capabilities, limitations, designs, classification, and primary functions of Army water transport equipment.

TM 55-501, Marine Crewman's Handbook describes procedures for training crewmen, outlines basic seamanship, and delineates marine and military regulations for the operation of Army water transport equipment.

TM 55-503, Marine Salvage and Hull Repair provides a ready reference and training guide for personnel engaged in the salvage and repair of Army marine hulls and related equipment. Includes tables of common materials and fastenings, docking plans for standard Army vessels, and a glossary of construction and repair terms.

TM 55-509, Marine Engineman's Handbook provides basic descriptive information on the principles of operation and maintenance of marine internal combustion engines, machinery, auxiliary equipment, and related systems.

TM 55-511, Operation of Floating Cranes, provides technical information on the operation of floating cranes as a guide in training crew personnel. Explains proper procedures for operating floating cranes under various sea and weather conditions and provides guidelines on operations requiring special rigging.



CHAPTER 2

THE ARMY WATER TRANSPORT FLEET

2-1. Background

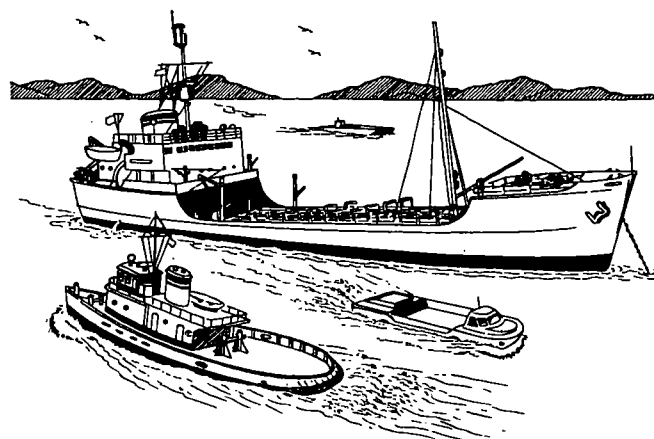
Upon its establishment on 31 July 1942, the Army Transportation Corps assumed responsibility for worldwide movement of cargo on oceangoing vessels owned or chartered by the US Army. The corps was also responsible for planning and executing movement of Army passenger and freight traffic on transports operated by the Navy and on commercial shipping. These missions generated a requirement for a variety of small boats and other floating equipment.

The Transportation Corps was responsible for procurement, maintenance, and logistic support of this fleet, which varied in design for harbor, coastwise, and interisland service. The exceptions were the vessels assigned to the Army Mine Planter Service of the Coast Artillery Corps, landing craft assigned to the amphibious engineers, and the rescue and retrieving vessels operated by the Army Air Corps. The vessels in the Transportation Corps fleet were under 1,000 tons gross, 200 feet or less in length, and both self-propelled and nonpropelled craft. They were officially classed as "small boats" or "harbor boats"—not altogether accurately descriptive terms since many of these designs were built expressly for coastwise and interisland service.

In December 1940, the Army had 386 harbor boats. By the end of World War II, its fleet had grown to 12,466 craft.

After the war, the submarine mine planting functions of the Coast Artillery Corps were transferred to the Navy, and the newly formed Air Force took over the air-sea rescue mission. In October 1949, the *Military Sea Transportation Service (MSTS)* was formed under the Department of the Navy and undertook the task of transporting persons and things on oceans, coastwise, interisland, and intratheater, thereby supplanting the long established Army Transport Service.

Transfer of these several functions and responsibilities left the Transportation Corps with water activities generally restricted to harbors, inland waterways, and logistic beach operations. However, the order establishing MSTS was modified in October 1955 to authorize the Army to operate marine craft in limited coastwise operations as a supplement to MSTS when the military situation so dictates. This arrangement was not altered when MSTS was designated the *Military Sealift Command (MSC)* in 1970.



2-2. Types of Craft

The Army water transport fleet provides water transport and floating utility service in harbor areas and inland waterways and along coastlines, and it provides lighterage service in beach operations. The fleet consists of four general groups of floating equipment—landing craft, amphibians, harbor craft, and coastal vessels.

An outline description of these craft is provided in this chapter; details of construction and performance for each item are contained in TM 55-500.

2-3. Landing Craft

Landing craft are designed primarily to transport wheeled and tracked vehicles between ship and shore in logistics over-the-shore (LOTS) operations, amphibious operations, and shore-to-shore operations, but may be employed in a utility role to move personnel and cargo in harbor areas, in inland waterways, in coastal operations, or in support of riverine operations. They are capable of beaching, loading and unloading vehicles across their bow ramps, and retracting under their own power. The Army currently employs three types of landing craft:

- The *LCM-8 (landing craft, mechanized, Mark VIII)*, a steel-hulled, diesel-powered craft with a 60-short-ton carrying capacity and an overall length of 73 feet 6 inches (fig 2-1).

- The *LCU (landing craft, utility)*. The current inventory consists of the 1466 class LCU (fig 2-2). However, a newer class—the 1646—is currently under production. The 1466 is 115 feet long and has a carrying capacity of 168 short tons. The 1646 class is 135 feet long, has a rated capacity of 180 short tons, and can attain speeds of 11 knots—3 knots faster than the older version. Both are steel hulled and diesel powered.

- The *BDL (beach discharge lighter)* (fig 2-3), a 338-foot vehicle lighter with a maximum cargo capacity of 2,464 short tons, a beaching capacity of 672 short tons, and a cruising range of 4,800 nautical miles. This ves-

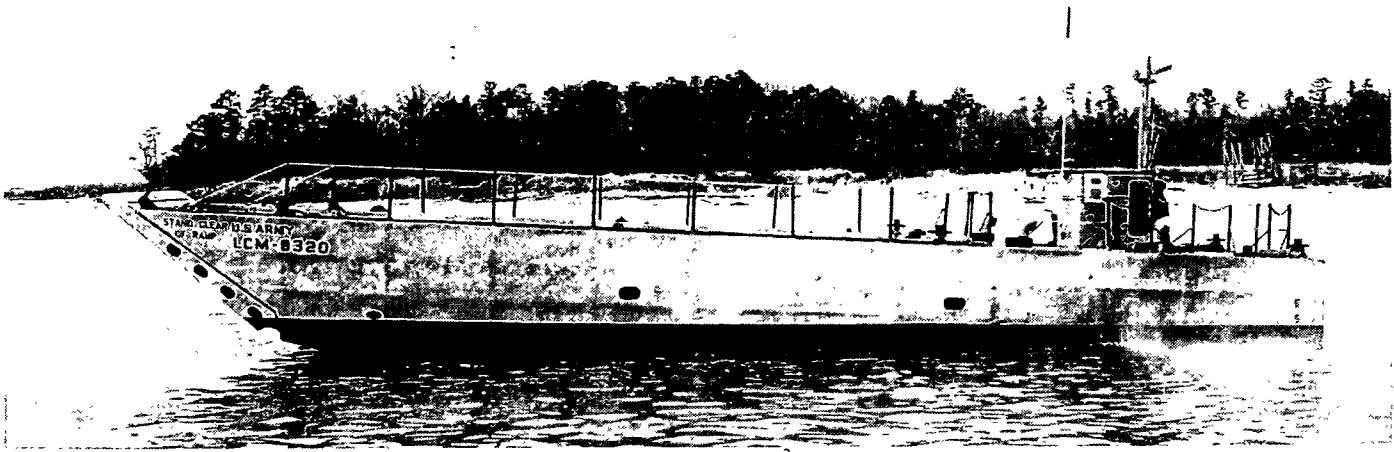


Figure 2-1. Landing craft, mechanized (LCM-8).

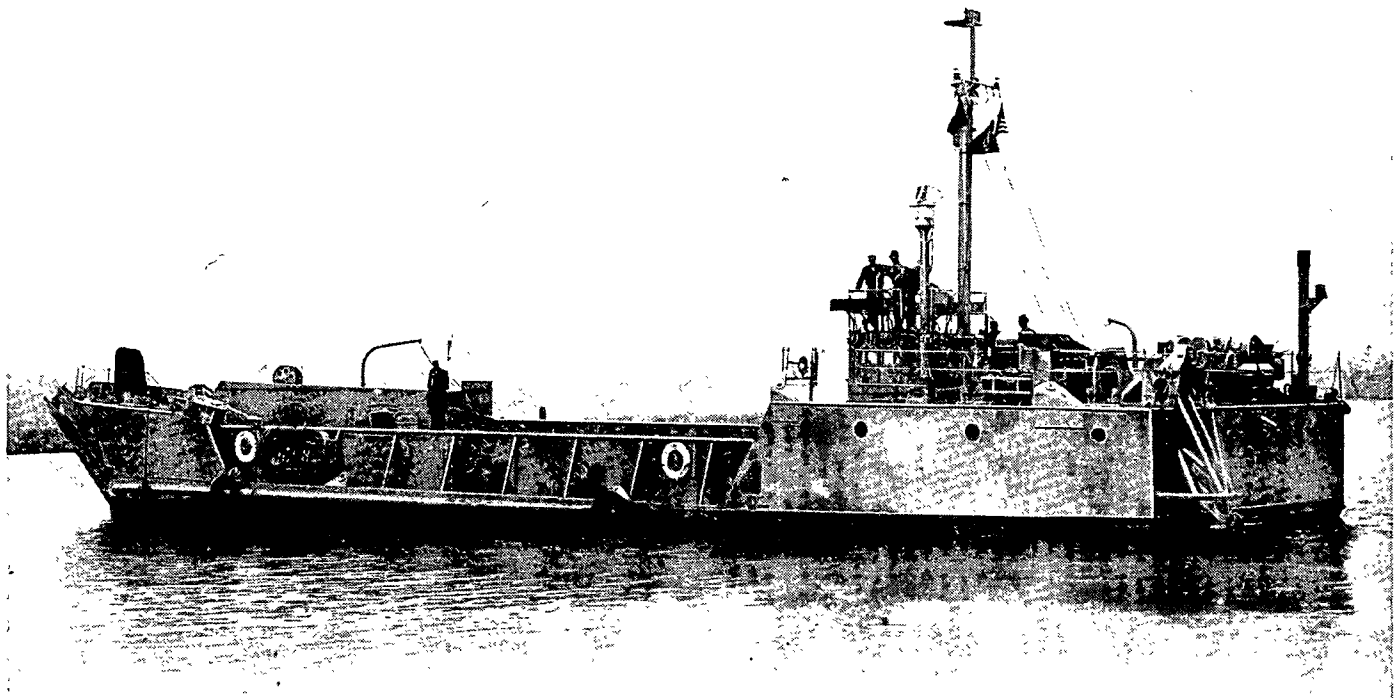


Figure 2-2. Landing craft, utility, 115 feet (LCU 1466 class).

sel, only one of which is currently in operation, is diesel-powered and driven by two six-blade, vertical-axis propellers.

2-4. Amphibians

The amphibians that are currently assigned to and operated by Army transportation units are wheeled water craft; however, developmental efforts are cur-

rently being directed toward procurement of air cushion vehicles capable of transporting containers between ships anchored offshore and shoreside transfer points. Amphibians offer advantages over landing craft in that they do not require wide beach areas (only a beach entrance and exit are needed) and that they can deliver cargo directly to the cargo in-transit holding area, thereby eliminating the rehandling of cargo

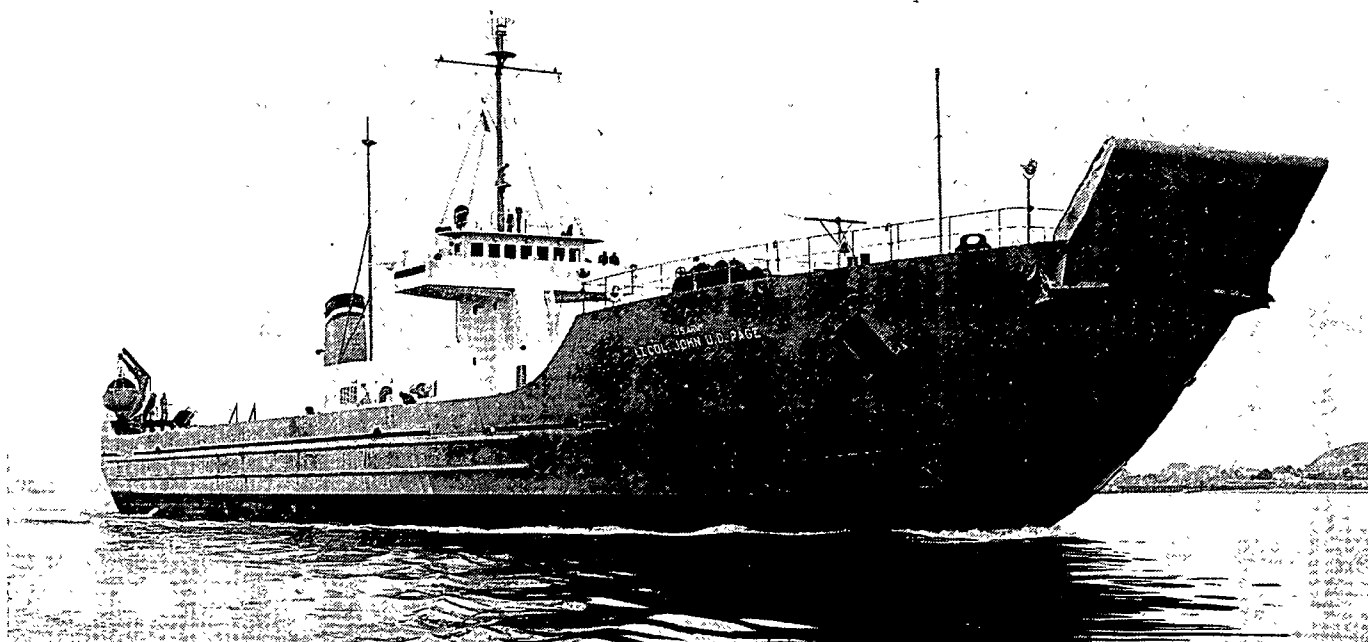


Figure 2-3. Beach discharge lighter, Mark I, design 5002.

at the beach area. The three types of amphibians currently being used are—

- The LARC-V (*lighter, amphibious, resupply, cargo, 5-ton*) (fig 2-4), a 35-foot, aluminum-hulled, diesel-powered amphibian with a 5-ton carrying capacity. This craft is designed to carry general cargo, which may be loaded into and unloaded from the lighter by cranes, ship's gear, conveyor belts, @-frames, wreckers, or forklift trucks.

- The LARC-XV (fig 2-5), a 45-foot, aluminum-hulled,

diesel-powered amphibian with a 15-ton carrying capacity. It may be loaded or unloaded by the same means listed above for the LARC-V, and small vehicles may be driven into or out of the cargo well across its bow ramp.

- The LARC-LX (fig 2-6), a 62-foot, steel-hulled, diesel-powered amphibian with a normal carrying capacity of 60 short tons and an emergency capacity of 100 short tons. It is designed to transport vehicles and other heavy, outsize items of cargo between ship and

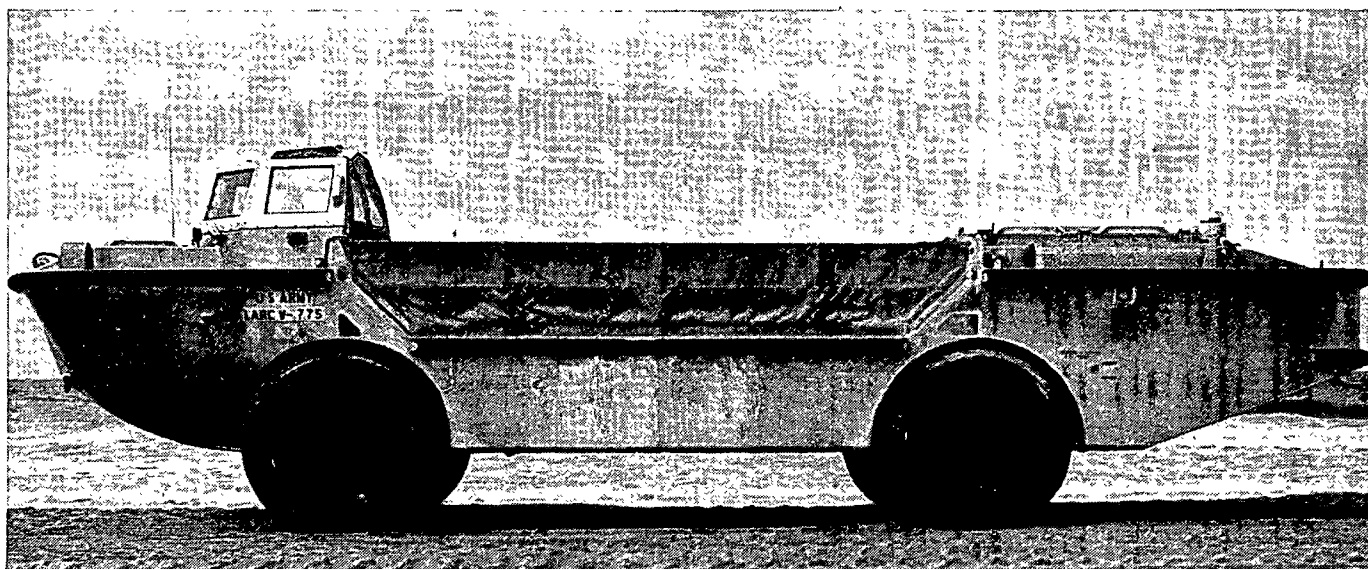


Figure 2-4. Lighter, amphibious, resupply, cargo, self-propelled, 5-ton, LARC-V, design 8005.

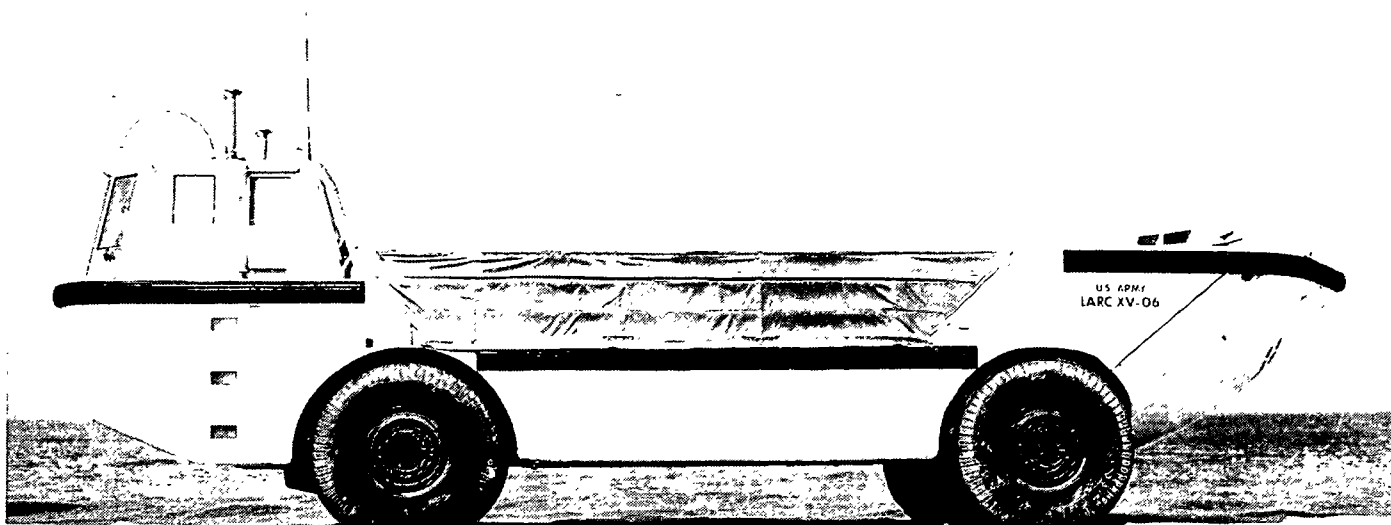


Figure 2-5. Lighter, amphibious, resupply, cargo, self-propelled, 15-ton, LARC-XV, design 8004.

shore. Cargo may be loaded into and unloaded from the LARC-LX by conventional means, and vehicles may be driven into and out of the cargo well across its bow ramp.

A significant number of combat-equipped troops can be transported in the LARC-LX under most sea conditions, but the configuration of the cargo well of the LARC-V and the LARC-XV, the dangers involved in loading personnel alongside ship, the difficulty of debarking ashore (from the LARC-V), and the lack of adequate weather protection during transit severely restrict the practicability of the smaller amphibians as personnel carriers. Consequently, movement of troops and patients (FM 8-35) should be planned primarily for the LARC-LX and the landing craft described in paragraph 2-3 above. Use of the LARC-V and the LARC-XV for troop transport should be undertaken only for short distances in emergency situations and when sea and surf conditions are relatively light.

2-5. Harbor Craft

The harbor craft fleet includes eight types of non-beaching vessels which are designed primarily to provide floating utility service in port areas. Some also have characteristics and capabilities that can be of use on inland waterways and in coastal and interisland work when circumstances require.

•*Tugs* are employed principally to assist large ships in docking and undocking and to move nonpropelled floating equipment in harbors and along inland waterways. They may also be used in salvage operations or for firefighting missions in harbor areas. The current Army inventory includes *tugboats* that range in length

from 45 to 143 feet. As indicated in table 13-3, the trans-hydro study published in 1973 revealed that there were as many as 13 design variations among the 9 sizes of tugboats in the Army inventory. Only the 45-, 65-, and 100-foot designs are classified as standard. The two larger models (100- and 143-footers) are suitable for extended coastal and interisland voyages and are capable of self-delivery overseas. The 100-foot design is illustrated in figure 2-7.

•*Picket boats* are used for transportation of personnel, for command and inspection, and for routine patrol missions in harbors and on inland waterways. Picket boats are designated as either J-boats or Q-boats, depending upon their length and design. The Q-boat (fig 2-8) has a wooden hull and is 65 feet in length. The J-boats (fig 2-9) are steel hulled and vary in length from 26 to 46 feet. Like the tugboats, there are presently a considerable number of design variations among the two types of picket boats.

•*Passenger and cargo boats* (T-boats) are used to move limited amounts of cargo and small groups of personnel between ship and shore or between shore points in harbor areas and on inland waterways. Here again, table 13-3 shows a considerable number of design variations. The standard design in this category (fig 2-10) is slightly over 65 feet long, can carry 24 passengers, and has a 27-short-ton-capacity cargo hold.

•*Cargo barges*—the Army's non-self-propelled barge fleet consists of *dry*, *liquid*, and *refrigerated cargo carriers*. The latter two categories have installed machinery to protect and service the specialized cargo they are designed to carry. The current inventory

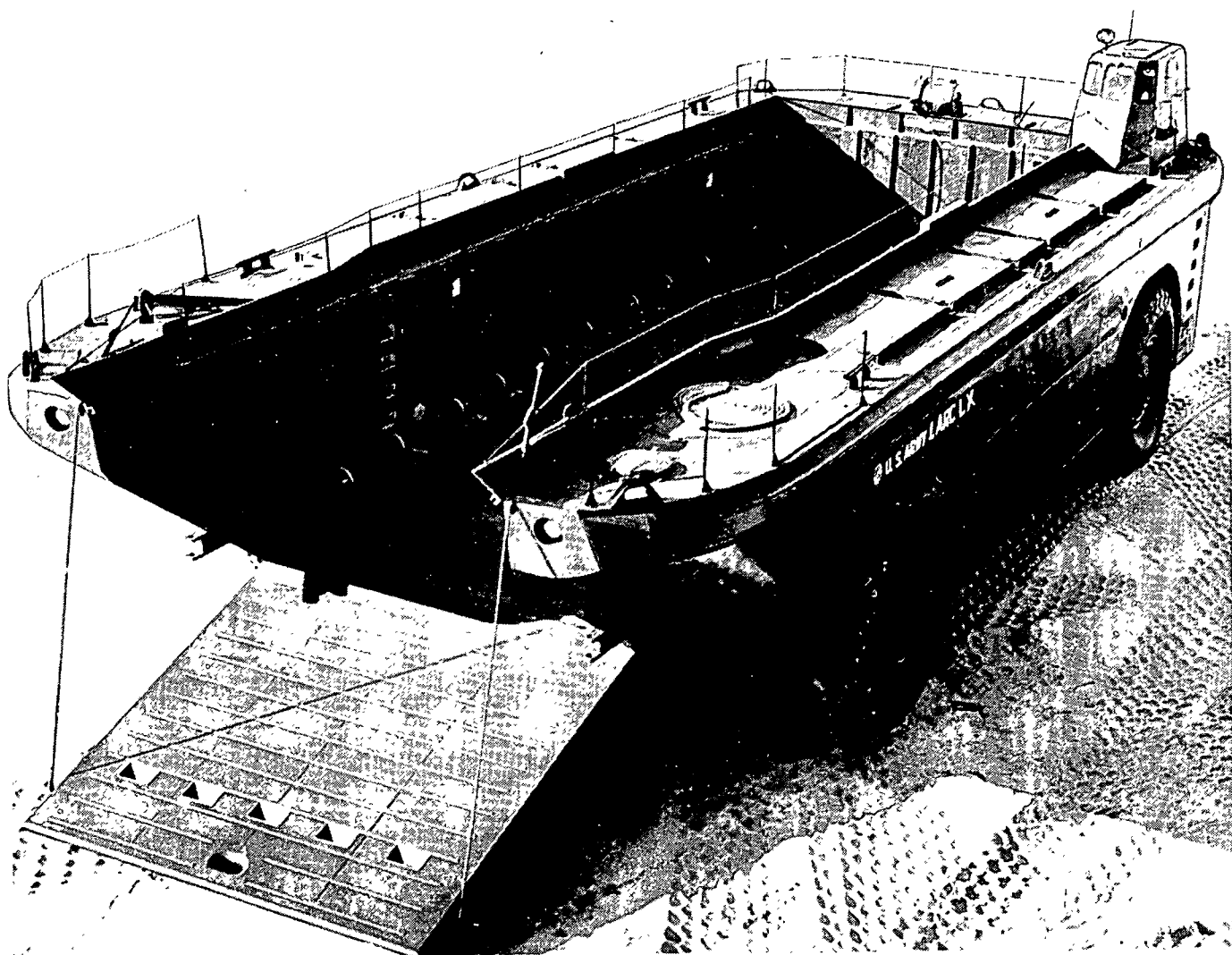


Figure 2-6. Lighter, amphibious, resupply, cargo, self-propelled, diesel, steel, 60-ton, 62-foot, LARC-LX, design 2303.

includes designs ranging from 45 to 130 feet. These barges are employed in harbors and inland waterways as cargo lighters, breasting barges, temporary piers, work platforms, and temporary cargo-holding facilities. The inventory also contains deck enclosure kits that provide cargo protection on flat barges and a variety of pontoon sections from which barges of varying sizes may be constructed.

•*Self-elevating pier barges (BPL)*—these nonpropelled craft contain air jacks and caissons by means of which they can be elevated above the water to form more stable working platforms than conventional floating barges. The inventory currently includes two sizes of BPL—150 by 60 and 300 by 90 feet (the 300-foot design is shown in figure 2-11). They may be installed as finger piers or in combinations to form T-head or L-head piers alongside which cargo ships, barges, and other lighters may be berthed. If BPL are to be employed as permanent piers, the caissons can

be welded to the barges and cut off at deck level to provide an unobstructed facility. When they are to be used as a temporary facility, the air jacks and protruding caissons (fig 2-11) must remain in place.

•*Floating cranes* are nonpropelled vessels used in loading and discharging heavy lifts that are beyond the capacity of the ship's cargo-handling gear. The Army currently employs both 60-long-ton- and 89-long-ton-capacity floating cranes. The larger crane (fig 2-12) is more commonly referred to as the 100-ton crane, which is its short-ton capacity. Floating cranes may also be used in *salvage, dredging, and piledriving operations*.

•*Floating repair shops (FMS)* provide waterborne shop facilities for the repair of Army watercraft in harbors and inland waterways, particularly where shoreside marine repair facilities are not available. The FMS (fig 2-13) is a 210-foot nonpropelled vessel with a 10-short-ton-capacity revolving crane, several

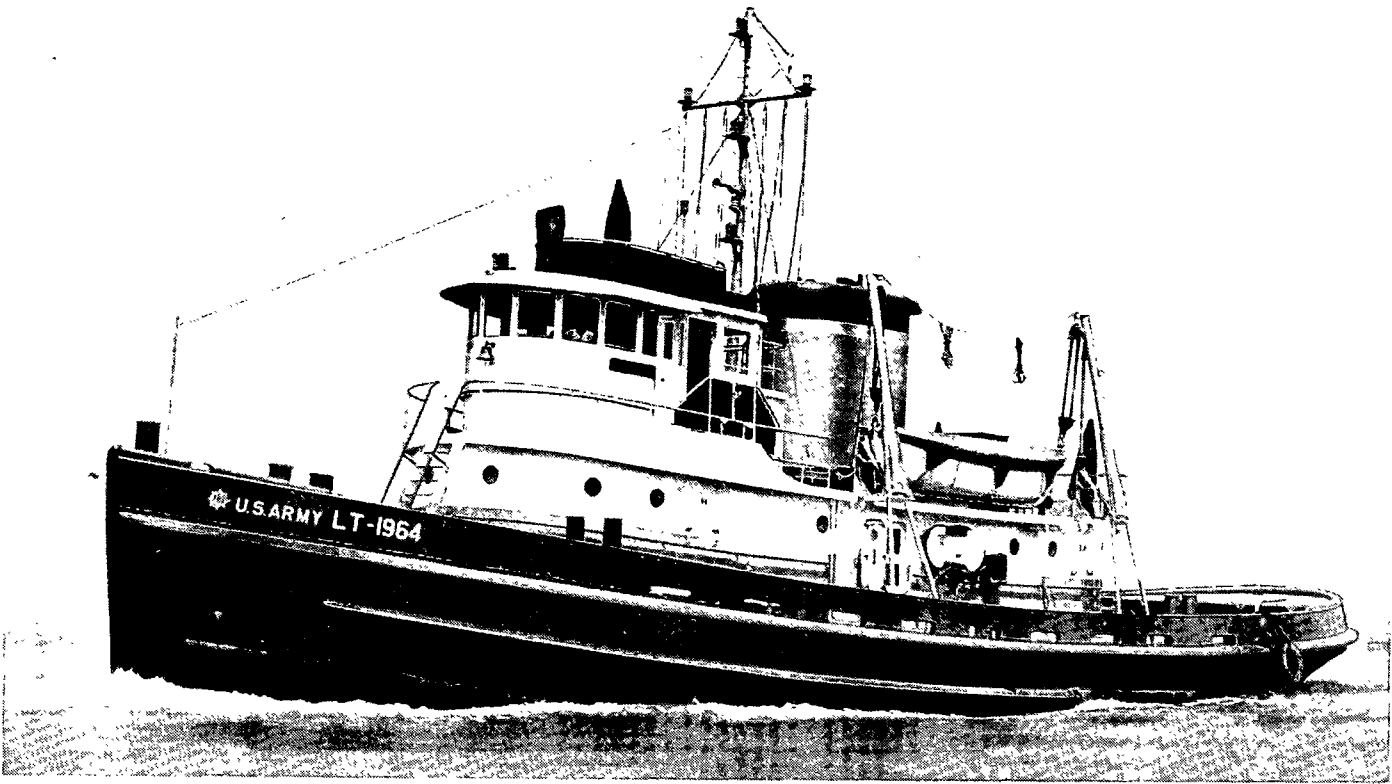


Figure 2-7. Tug, 1,200-horsepower, design 3006.

monorail trolley systems, and a wide variety of repair shops (blacksmith, electrical, engine, machine, radar and radio, etc.)

2-6. Coastal Vessels

The current inventory includes a small number of

Army-operated coastal vessels that range from 159 feet to 417 feet in length. These vessels were specifically designed to carry either dry, refrigerated, or liquid cargo (a dry cargo vessel is shown in figure 2-14). Before the US disengagement from the Vietnam conflict, these vessels were used in the theater of

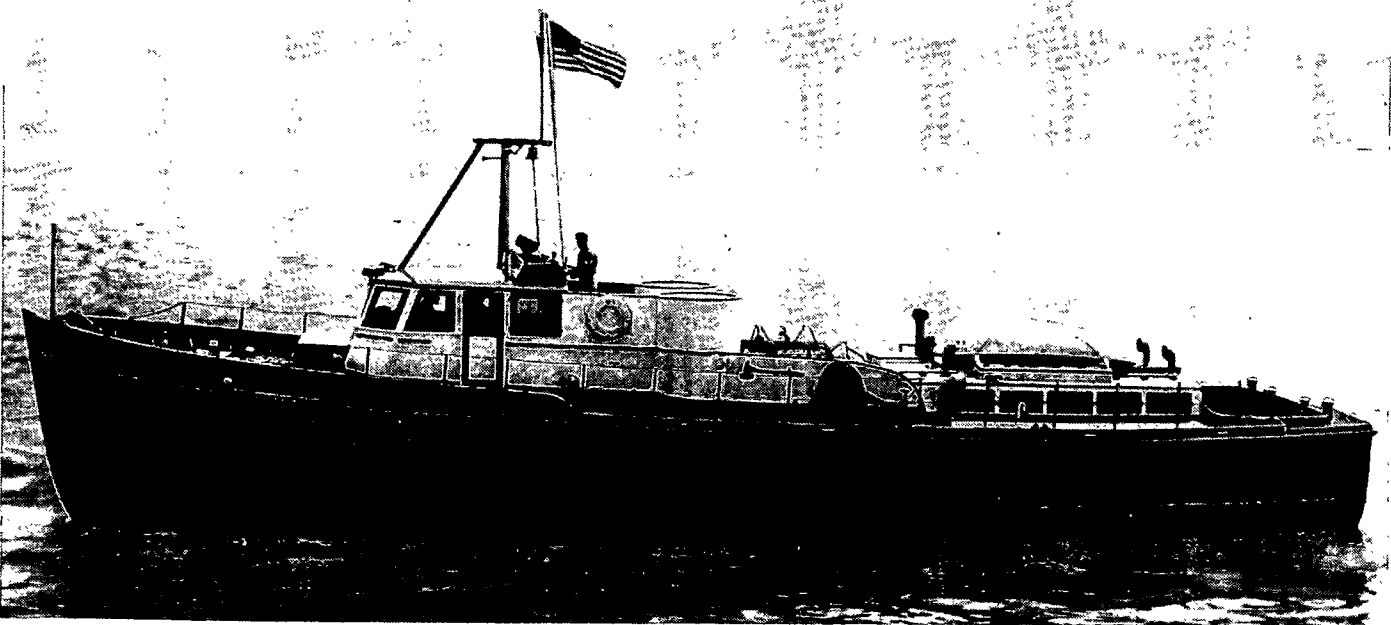


Figure 2-8. Picket boat, design 4002 (Q-boat).

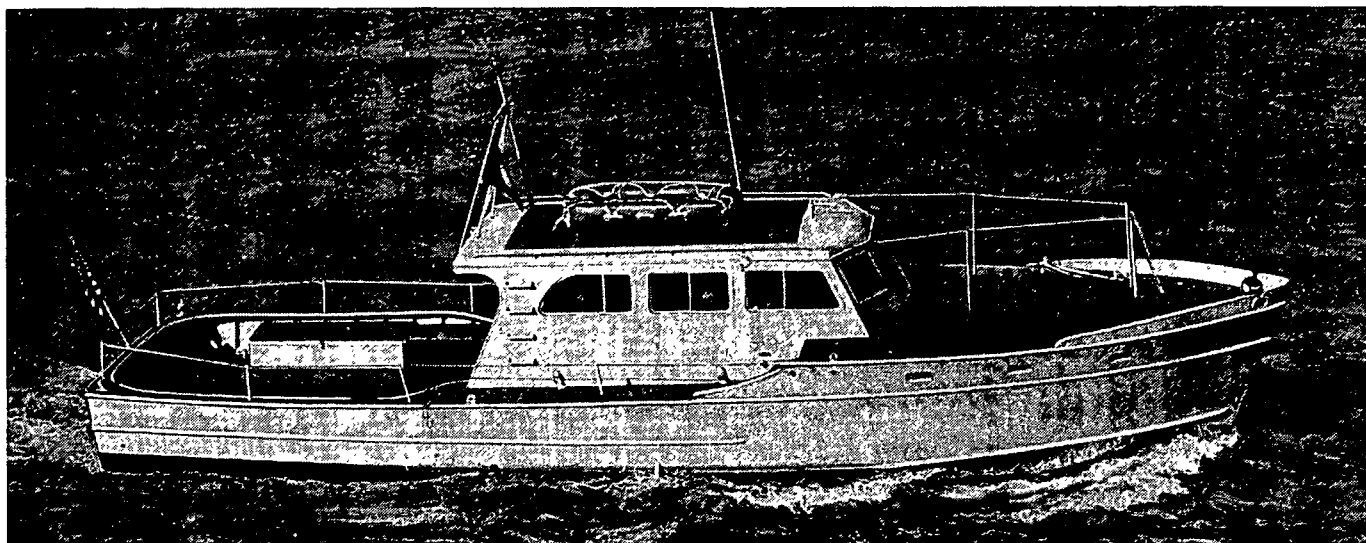


Figure 2-9. Picket boat, design 4008 (J-boat).

operations to transport cargo along coastal routes to military terminals or bases not regularly served by Navy vessels, for intratheater relocation of cargo, and for forward cargo movement on major inland waterways. Due to their advanced age (approximately 30 years), the majority of these vessels have been retired from Army service. Those vessels still in the inventory are used primarily for training purposes.

Although the beach discharge lighter described in paragraph 2-3 is primarily a landing craft capable of beaching, it is also capable of long ocean passages and is used extensively in coastwise and inland waterway missions. The LCU may be similarly employed—although to a somewhat lesser extent—and the larger tugs described in paragraph 2-5 can be used for coastal towing in a supplementary role.

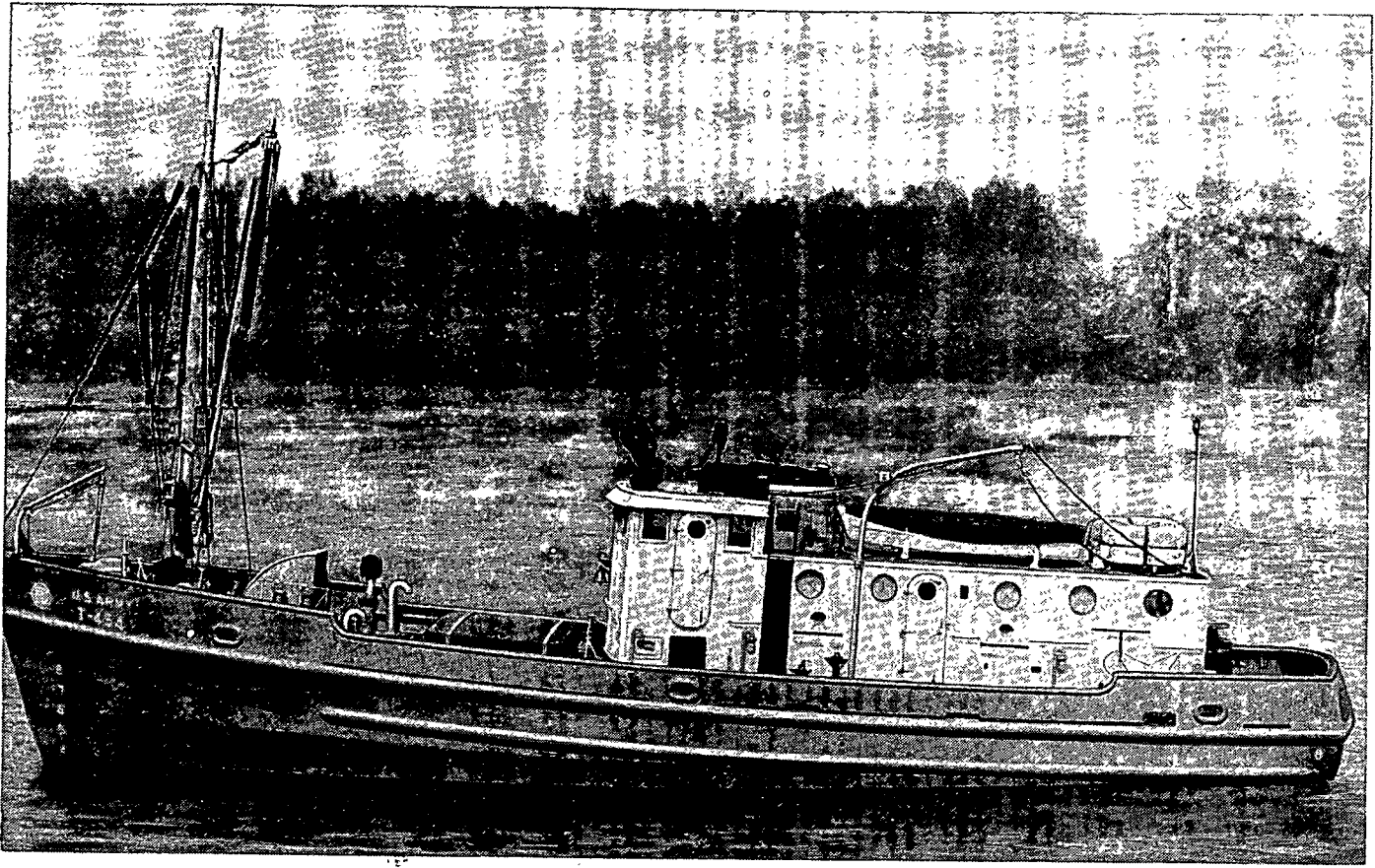


Figure 2-10. Passenger and cargo boat, design 2001 (T-boat).

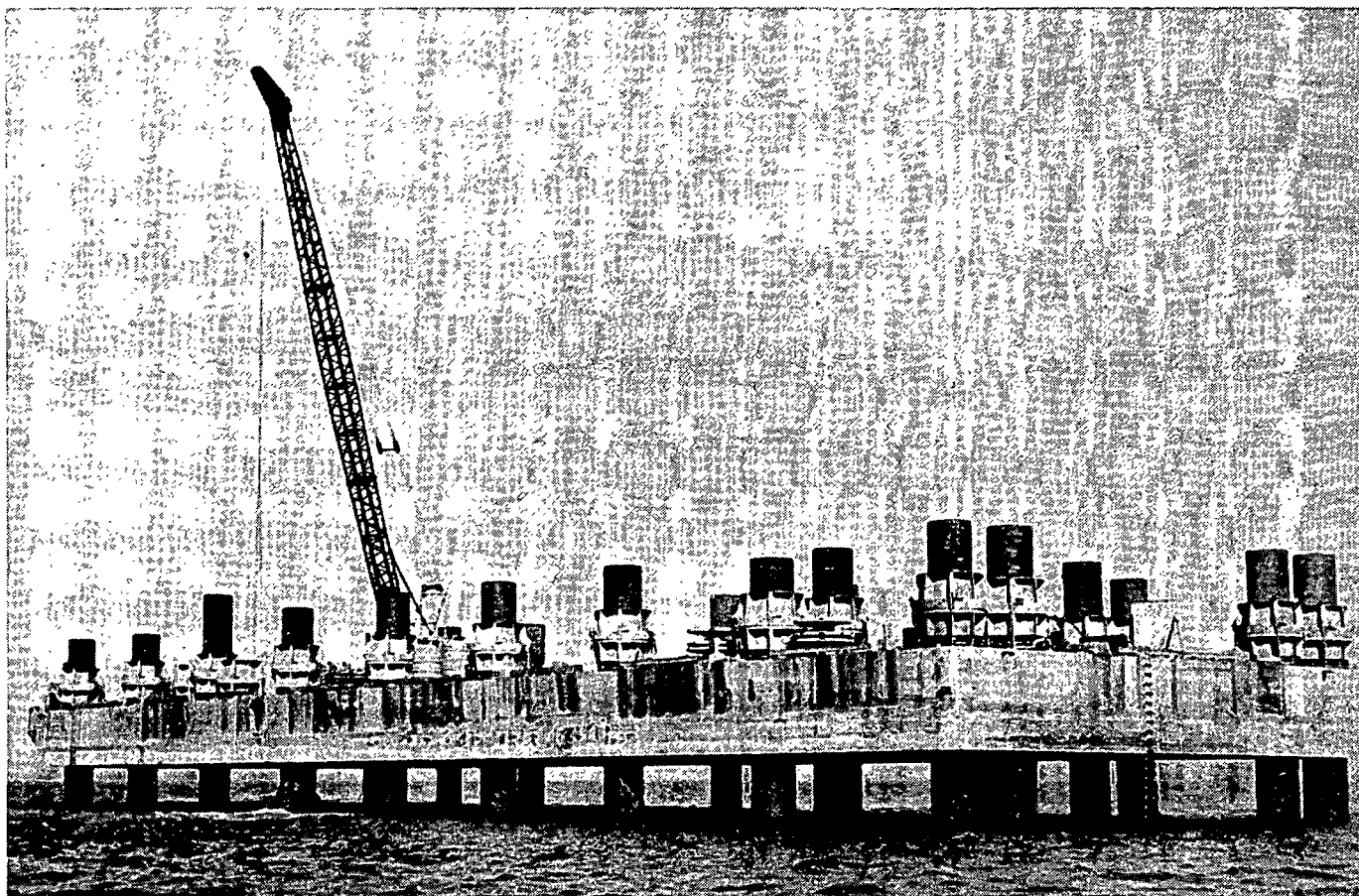


Figure 2-11. Pier, barge type, self-elevating, nonpropelled, steel, 300 feet long, 90 feet wide, design 7026.

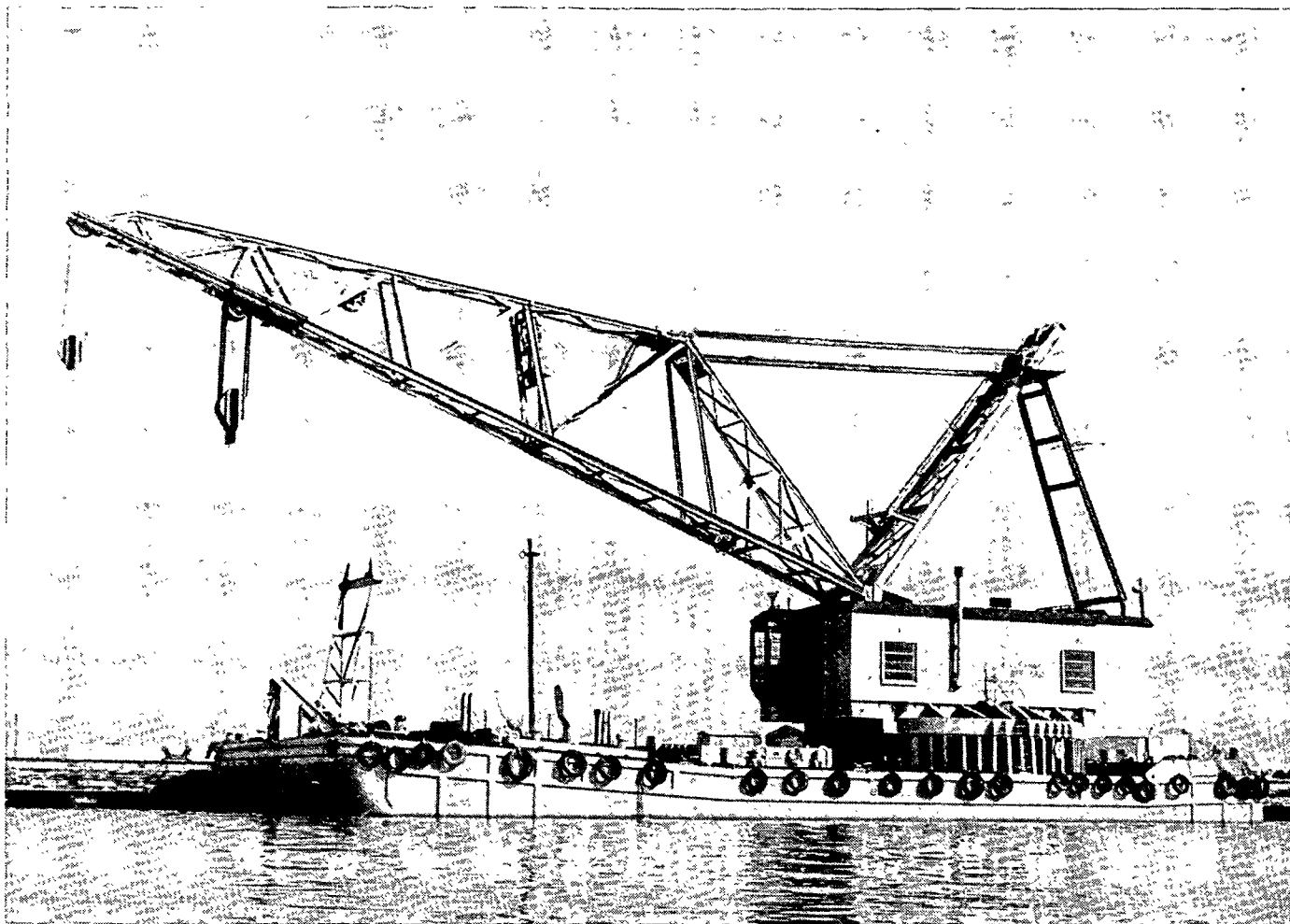


Figure 2-12. Crane, barge, 89-long-ton, design 264B.

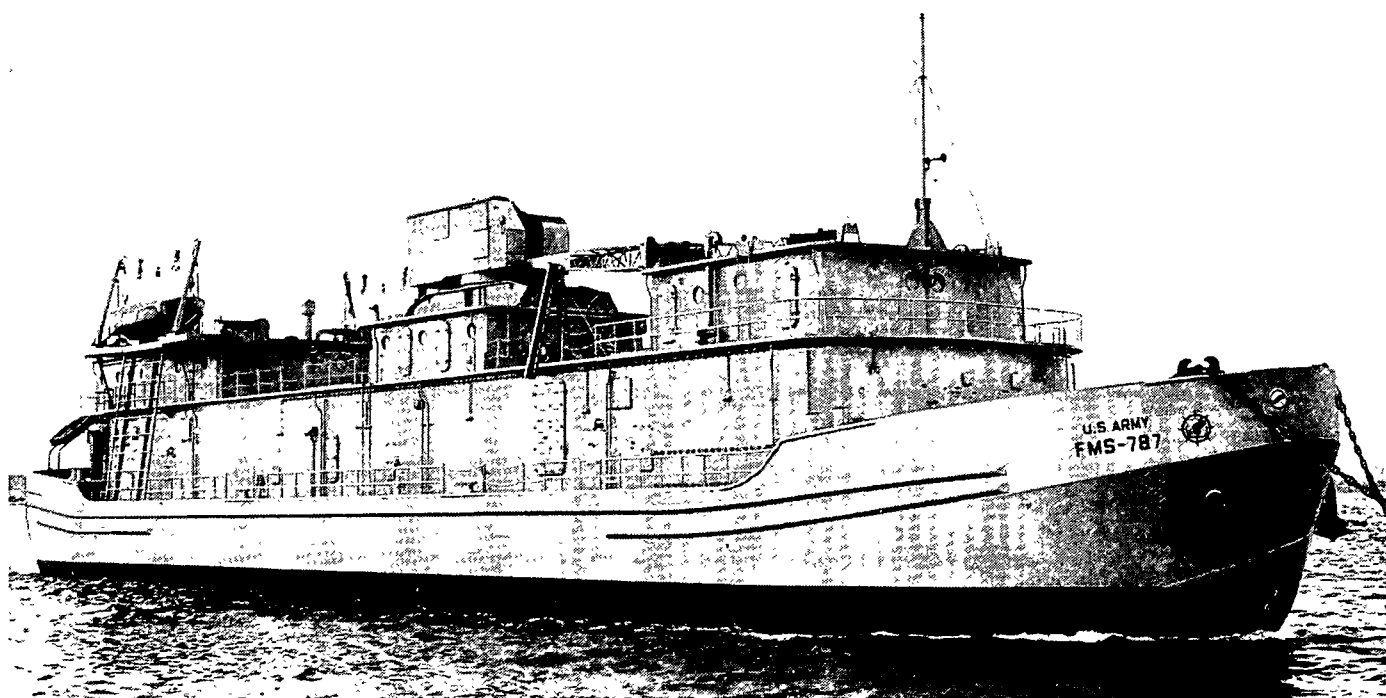


Figure 2-13. Repair shop, floating, marine equipment, nonpropelled, design 7011.

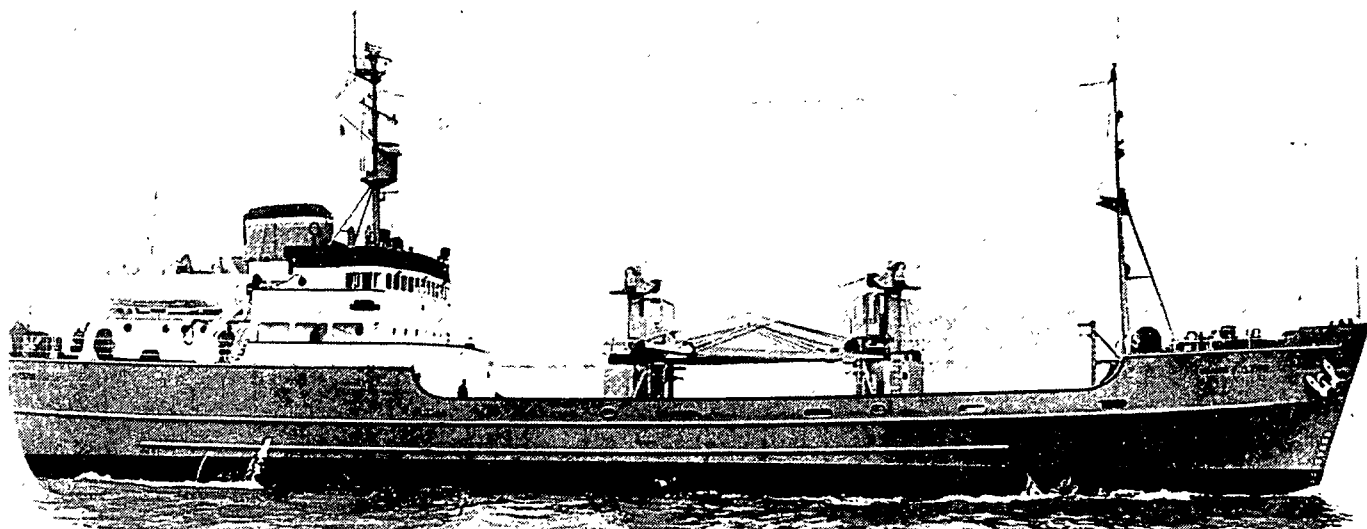


Figure 2-14. Freight supply vessel, design 7018.



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CHAPTER 3

WATER TRANSPORT ORGANIZATIONS

3-1. Command Relationships

The Army water transport fleet may occasionally be committed to combat support functions in a corps support command (COSCOM), but its operations are largely confined to combat service support roles in the communications zone.

The command element in the communications zone is the theater army headquarters (TAHQ), which provides an integrated support system for two or more corps.

The TAHQ operational area extends from the ocean terminals of the theater to the rear boundary of the COSCOM, thereby providing the necessary link between the combat force and its source of manpower and materiel replenishment in the continental United States.

The TAHQ may be organized with as many as five commands, which operate on a perpendicular axis from the water's edge forward to the COSCOM area.

A *transportation command* is one of the five mission commands of the TAHQ. It has the necessary movement control, motor transport, terminal service, rail, aviation, and water transport units to provide an integrated transportation system capable of supporting the TAHQ mission. The transportation command receives personnel replacements and supplies at ship-side, air terminals, or rear area depots and delivers them as far forward as possible toward the combat zone with minimum unloading, reprocessing, rehandling, or transshipping at intermediate points. The operational functions of the transportation command are detailed in FM 55-1.

All Army water transport units in a theater normally operate as part of a terminal service organization and are attached to and commanded by elements of the terminal organization. *There are no water transport organizations above company level in the Army today.*

Depending upon the size and complexity of the theater, the senior terminal headquarters under the transportation command will be either a terminal group (TOE 55-112) or a terminal brigade (TOE 55-111). The group provides command, planning, supervision, and coordination of the operations of up to six terminal battalions. In divided theaters or in large theaters requiring two or more groups, a terminal brigade will be assigned to provide an intermediate level of com-



mand, thereby becoming the terminal "mission" headquarters for the theater.

The terminal battalion (TOE 55-116) is the basic operating element in the theater terminal structure and provides direct command, control, and operational supervision over water transport units, as well as over the terminal service companies charged with handling cargo on the ships and at the beach and over other units which may be attached to the battalion to support or meet specialized mission requirements. A complete description of theater terminal operations is contained in FM 55-60.

The Army water transport fleet is employed in the following organizational increments:

- Transportation medium boat company (LCM-8) (TOE 55-128).
- Transportation heavy boat company (LCU) (TOE 55-129).
- Transportation light amphibian company (LARC-V) (TOE 55-138).
- Transportation medium amphibian company (LARC-XV) (TOE 55-139).
- Transportation watercraft teams (all harbor craft, coastal vessels, the beach discharge lighter (BDL), and the LARC-LX) (TOE 55-530).

Introductory descriptions of these units follow in the remainder of this chapter. Details of organization, duties of individual personnel, functions of organizational elements, and internal unit procedures are given in FM 55-51.

3-2. Medium Boat Company

The transportation medium boat company is equipped with 19 landing craft, mechanized, Mark VIII (LCM-8), and has the mission of transporting vehicles and heavy lifts between ship and shore or from shore to shore in logistic beach operations or in support of amphibious or riverine operations. The unit is normally attached to a terminal battalion or a terminal group for operational control. A full-strength company is capable of transporting an average of 1,000 short tons of cargo per 20-hour day in normal around-the-clock, ship-to-shore operations or 960 short tons in a one-time lift.

3-3. Heavy Boat Company

The transportation heavy boat company is equipped with 12 landing craft, utility (LCU), and has the mission of transporting vehicles, heavy cargo, and personnel in ship-to-shore operations, over navigable rivers, in harbors, and along inland and coastal waters. The unit is normally attached to a terminal battalion or a terminal group for operational control. It is capable of transporting 2,100 short tons of vehicles, 1,440 short tons of cargo, or 16,000 troops per day in normal lighterage operations. In a one-time lift, a full-strength company can move 1,800 tons of cargo or 4,800 troops.

3-4. Light Amphibian Company

The transportation light amphibian company is equipped with 35 lighters, amphibious, resupply, cargo, 5-ton (LARC-V) and has the mission of providing lighterage for the movement of general cargo between ship and shore or from shore to shore in logistic beach operations, in which case it is normally attached to a transportation terminal battalion. It may also be attached to a shore party organization to provide combat service support in an amphibious operation. A full-strength light amphibian company is capable of transporting approximately 1,000 short tons of general cargo per day in around-the-clock operations. The productivity of the light amphibian company is directly related to the discharge rates of the terminal service company working the ship, and the amount of cargo delivered ashore will vary significantly as the hatch rates change.

3-5. Medium Amphibian Company

The transportation medium amphibian company is equipped with 25 lighters, amphibious, resupply, cargo, 15-ton (LARC-XV), and has the same mission, assignment, and capability as given above for the light amphibian company. The employment of this unit in place of or along with the light amphibian company is governed largely by the type of cargo to be lightered and the nature of the terrain in the discharge area.

3-6. Watercraft Teams

In addition to the heavy amphibian team for the LARC-LX, TOE 55-530 provides 14 types of crews for coastal, harbor, and inland waterway vessels. These teams are normally assigned to a terminal battalion or a terminal group. Depending upon the mission, they may be assigned singly or in combination as a watercraft platoon or company organized under TOE 55-500. Due to periodic TOE changes, the current TOE 55-530 should be referred to for personnel grades, MOS, and team composition.

Unless specifically provided in the individual teams, each must be furnished personnel, administration,

supply, mess, and organizational maintenance support. If not provided by the unit to which they are attached, these services must be made available by the additional attachment of service organization teams from the 55-500 series TOE. All the teams listed below, except team FA, are manned for 24-hour operation. (See FM 55-51 for organizational details and TM 55-500 for detailed vessel descriptions.)

Team FA provides the crew for nonpropelled cargo barges, except those equipped with pumping machinery for the transport of bulk liquid cargo and those with refrigeration equipment.

Team FB operates the 46-foot and smaller picket boats (J-boats) which are used to provide water transportation for patrol, command, inspection, and general utility services.

Team FC consists of marine enginemen and deck personnel required to operate the pumps and to crew the 120-foot, non-self-propelled liquid cargo barge. It has a capacity of up to 4,160 barrels of liquid cargo, or up to 655 short tons of dry cargo may be transported on deck.

Team FD is the manning crew for the 45-foot harbor tug (ST), which is used to tow small nonpropelled barges in sheltered harbors and along inland waterways. It may also be used to assist in firefighting, patrolling, and general utility work. The team size and composition permit it to be split into two crews to provide two-shift operation of the vessel.

Team FE provides a two-shift crew for operation of either the 65-foot passenger and cargo boat (T-boat) or the 65-foot picket boat (Q-boat).

Team FF includes the necessary engine, refrigeration, and deck personnel required to operate and maintain the 120-foot, non-self-propelled refrigeration barge. The barge is capable of transporting or temporarily storing approximately 355 short tons of refrigerated cargo.

Team FG has the necessary personnel to operate the 65-foot tug (ST) on a 24-hour basis. Operational missions performed by this team include firefighting, shifting and towing barges, and assisting in docking and undocking large vessels.

Team FH provides a crew for the 60-long-ton non-self-propelled floating crane. The 89-long-ton (usually referred to by its 100-short-ton capacity) floating crane is operated by the FI team.

Team FJ is organized to provide a 24-hour operating capability for the 100-foot large tug (LT). This capability enables the tug to deploy overseas under its own power and to make limited offshore tows between terminals when MSC (Military Sealift Command) tow capability is not available. In addition to coastal, harbor, and inland waterway towing, the tug is capable of berthing and unberthing oceangoing vessels.

Team FK is used to meet the crewing requirements for the 126-foot oceangoing tug.

Team FL is used primarily as the manning basis for the 223-foot self-propelled dry cargo (7013) and liquid cargo (7014) barges, but the crew complement may also be tailored to fit the crewing requirements of the other coastal vessels mentioned in paragraph 2-6.

Team FM, which is the largest watercraft team, operates the 338-foot beach discharge lighter (BDL). The BDL is capable of transporting large quantities of vehicles, outsize equipment, unitized cargo, and containers from ships standing offshore.

Team FN is the only watercraft team that includes more than one crew and more than one item of watercraft. The FN team is equipped with four LARC-LX craft and four operating crews. It is also the only team that is authorized commissioned officers (detachment commander and assistant detachment commander) and a maintenance capability in addition to the vessel

crew members. The FN team is also authorized logistic and administrative personnel, which reduce the support requirements that must be provided by other sources.

Team FO is used to meet the crewing requirements for the 143-foot diesel-electric oceangoing tug.

There are two additional types of transportation watercraft which are not authorized in the company-size units or teams discussed in this chapter. They are the nonpropelled floating marine equipment repair shop (FMS) and the nonpropelled self-elevating barge piers (BPL) described in paragraph 2-5. The FMS is authorized in the transportation floating craft general support maintenance company (TOE 55-157), which is described in FM 55-51. The BPL are obtained as required by initiating TDA (table of distribution and allowances) requests.



CHAPTER 4

OPERATIONAL ENVIRONMENT

4-1. Types of Operations

The operations of the Army water transport fleet are dedicated primarily to supporting the movement of military cargo through and between Army water terminals. Water terminal operations are conducted at established ports and over beaches and are an integral part of inland waterway, amphibious, and shore-to-shore operations.

An introductory description of the water transport fleet's operating environment is provided in this chapter; a more detailed discussion of these operations is contained in chapters 5 through 9.

4-2. Fixed Port Terminal Operations

Fixed port terminals are developed shoreside installations at which passengers or cargo are transshipped between oceangoing ships and land transport equipment. Such terminals may vary in size from large deepwater complexes containing several wharves, anchorage areas, shore-based cranes, drydocking facilities, cargo sheds, sorting and temporary holding areas, rail sidings, etc., to small, shallow-draft, one- or two-wharf facilities with minimum provisions for cargo handling, storage, and clearance. A complete description of water terminal operations is contained in FM 55-60.

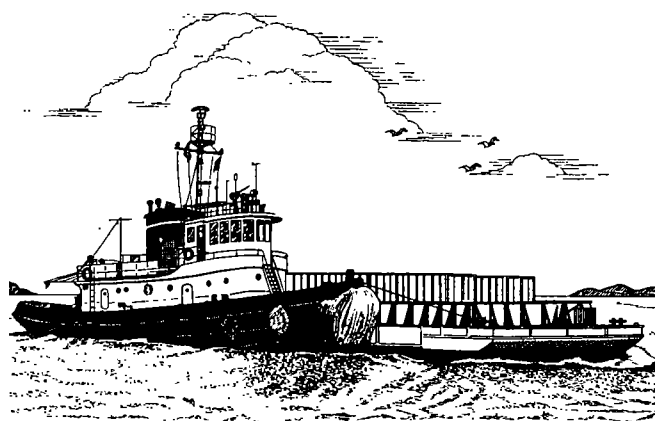
4-3. Logistics Over-the-Shore Operations

In logistics over-the-shore (LOTS) operations, ships are loaded and unloaded without benefit of fixed port facilities in friendly or nondefended territory and, in time of war, during phases of theater development in which there is no opposition by the enemy. These operations may be conducted from ship to shore or from shore to shore.

LOTS operations may be instituted to supplement or increase tonnage capabilities of an existing terminal, to replace the tonnage capacity of a terminal made untenable by enemy action, to relieve congested lines of communication, or to reduce the land transportation required to support combat forces.

4-4. Inland Waterway Operations

An inland waterway in a theater of operations is normally operated as a complete system involving—singly or in combination—rivers, lakes, canals, or intracoastal waterways and two or more water termi-



nals. These waterways are normally used for civilian traffic but can be used for military traffic when civilian use has been suspended or limited.

Inland waterways can be used to relieve the pressure on other modes of transportation and are especially useful for moving a large volume of bulk supplies and heavy, outsize items not easily transported by other means. Inland waterways are an economical means of transport, but they are relatively slow compared to other modes and are especially vulnerable to enemy action and to climatic changes.

4-5. Amphibious Operations

An amphibious operation is an attack launched from the sea by naval and landing forces involving a landing on a hostile shore to gain a lodgment area from which to carry out further combat operations ashore, to obtain an advanced air or naval base area, or to deny the use of seized positions to the enemy. A tactical withdrawal of troops from land involving Navy ships may also be termed an amphibious operation.

4-6. Shore-to-Shore Operations

A shore-to-shore operation is a land force operation involving a water crossing in assault craft, or in assault craft and aircraft, for the purpose of establishing a force on or withdrawing it from the far shore. LOTS operations may be conducted as part of or in support of a shore-to-shore operation.

4-7. Riverine Operations

The basic nature of riverine operations is sustained ground combat in a land environment dominated by water lines of communication. The area may contain an extensive network of rivers, streams, canals, paddies, swamps, or muskeg extending over broad, level terrain, parts of which may be inundated periodically or permanently. It may include sparsely populated swamps or forests, rivers and streams that have steep banks densely covered with tropical trees or bamboo, and relatively flat, open terrain. Ocean tides may affect riverine areas near the seacoast.

Riverine warfare is all the military activities designed

to achieve and/or maintain territorial control of a riverine area by destroying enemy forces and restricting or eliminating their activities. The significant characteristic of riverine operations is the extensive use of joint waterborne forces along with groundmobile and airmobile forces in a predominantly land battle. This type of warfare is distinct in that it requires continual use of specialized watercraft, equipment, and techniques and usually takes place where amphibious operations are not practicable.

4-8. Waterborne Security

Waterborne security support is provided by the military police river/harbor security company. This unit is equipped with 10 river patrol boats and has the mission of providing waterborne security patrols in harbor areas and on inland waterways. It is normally placed in direct support of or attached to a terminal group. A detailed description of this unit and its functions is contained in FM 19-30.

CHAPTER 5

LOGISTICS OVER-THE-SHORE OPERATIONS

5-1. Introduction

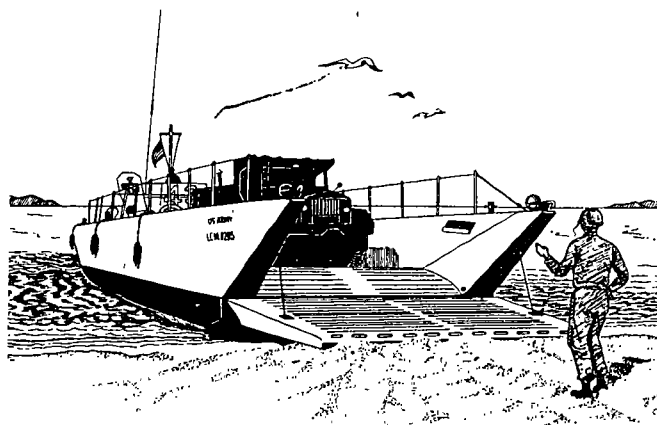
Because of the probability that existing port capacities in many operational areas will be insufficient to support theater tonnage requirements and of the possibility that the enemy may employ nuclear weapons, terminal planning must be directed toward widely scattered beach operations rather than toward large port complexes.

Dispersion generally reduces vulnerability but increases the problems of command and control and should therefore be kept to a minimum consistent with the commander's estimate of the threat from area destruction weapons. Normally, the direct line distance between ships and between ships and major shoreside activities or built-up areas should be at least 1 nautical mile. To avoid creating targets for large long-range nuclear weapons, not more than two ships should be handled simultaneously at one logistics over-the-shore (LOTS) site and these should be kept at least 1 nautical mile apart. The distance between each of these two-ship operations should be 5 nautical miles or more.

Each two-ship terminal will be under the direct operational control of a terminal battalion and will be manned by two terminal service companies (TOE 55-117) and an appropriate number of amphibian and landing craft components. In addition, truck companies may be attached for intraterminal transportation and clearance assistance and a terminal transfer company (TOE 55-118) may be required to aid in clearing cargo backlogs in the discharge areas. Harbor craft teams and maintenance detachments or companies (chap 10) may also be attached as required. Ships will be anchored up to 5 miles offshore. Amphibians will transport cargo across the beach to multiple discharge points located as close behind the beach as possible, and landing craft will deliver vehicles, containers, and personnel to waterline discharge sites. The functions of a number of these terminals, dispersed along a maximum of 150 miles of shoreline, will be coordinated by a terminal group or brigade.

5-2. Beach Reconnaissance

The initial step in planning for beach operations is the *selection of a beach site*. Selection of the general operational area is made by the terminal group or brigade



headquarters in coordination with the Navy and the Military Sealift Command.

Location of the exact site is then determined by a beach reconnaissance party made up of representatives of the terminal group, the commander and the operations officer of the terminal battalion that will operate the site, a military police representative, and the commanders of the terminal service, boat, and amphibian companies involved. During the reconnaissance, the terminal battalion commander selects and assigns company areas and frontages, indicates areas of defense responsibilities, and tentatively organizes the area of operations.

The water transport unit commanders are expected to provide advice and recommendations on factors and conditions affecting the employment of their units, and these recommendations will have a direct bearing on the final choice of the exact operational sites.

When nuclear-biological-chemical operations are suspected, the beach reconnaissance party conducts radiological monitoring and survey and chemical agent detection activities to determine the possible contamination of the prospective beach sites. Areas found to be hazardous are posted in accordance with STANAG 2002 as discussed in FM 21-40.

5-3. Beach Characteristics

In selecting a specific area for beach operations, the water transport unit commander is particularly interested in the following physical and environmental characteristics (for a detailed discussion of these characteristics, see chapter 12):

- Composition of the beach.
- Beach gradient at various stages of the tide.
- Length and width of beach.
- Depth of water close inshore.
- Tidal range and period—duration and variation of high and low water; effect of tides on the beach width.
- Wind and weather conditions in the area.

5-4. Operational Planning

Employment of lighters in beach operations must be

planned to achieve a balanced operation in which the turnaround time of the lighters matches as closely as possible the unloading and loading cycle of the terminal service units involved. Balance cannot be maintained unless craft are unloaded at discharge points at least as fast as they are loaded at shipside. Every effort must be made to insure that there are enough lighters available to accept and deliver all the cargo that the terminal service personnel are capable of handling.

Undue delays at loading and unloading points must be held to an absolute minimum, and the operation should be set up so that a lighter is alongside a hatch being worked each time the cargo hook is ready to lower a draft. This can be done by having one or more craft on standby at shipside while one is being loaded and others are being dispatched from the beach at intervals equal to the loading time at the hatch.

- **Sandbars**—distance offshore, width, length, consistency, slope seaward and landward, depth below water at various tidal stages, and inshore water, including depth and nature of bottom.

- **Rocks and shoals**—location, extent, size, and height above or depth below water at various tidal stages.

- **Reefs**—width of reefs; length, slope, height, or depth below water at various tidal stages; nature of reef surface; effect of reef on surf and tide conditions; presence of channels, including location, depth, width, and possibilities for improvement; distance offshore of barrier reefs; depth, nature of bottom, and landward slopes of lagoons.

- **Seaweed**—location, extent, and type (such as kelp, rockweed, sea lettuce).

- **Current**—location, type, direction, and speed of offshore and inshore currents; dangerous sea conditions such as rips and undertows.

- **Surf conditions**—distance from the shore at which breakers form, average height of breakers from crest to trough, average distance between crests, types of breakers, number of lines of breakers, period of breakers, the width of the surf zone, and the angle at which the surf strikes the shore.

Information obtained from actual operating experience should be used in planning for lighter employment in beach operations but, when these data are not available, factors noted in this manual and in FM 101-10-1 and FM 55-15 may be substituted therefor.

5-5. Turnaround Time

Turnaround time is the basic factor in determining lighterage capabilities and requirements. It is used in determining the number of craft required for a specific operation or the amount of tonnage that can be delivered by a given number of craft. Turnaround time is the total elapsed time that a single lighter takes to load, travel to the discharge point, unload, and return to shipside ready to be loaded again. The elements

involved are average speed in the water and on land (for amphibians), distances to be traveled, loading time, unloading time, and predictable delays.

An estimate of turnaround time must be worked out for each new operational site and mission and for each change in any of the elements given above. Speeds will be affected by sea and terrain conditions, and variations among loads will alter loading and unloading times.

Average turnaround time is computed by using the following formula:

Turnaround time in hours =

$$\begin{aligned} & \frac{\text{water distance (round trip)}}{\text{water speed (mph)}} \\ & + \frac{\text{land distance (round trip)}}{\text{land speed (mph)}} \\ & + \text{loading time in hours} \\ & + \text{unloading time in hours} \\ & + \text{delays in hours} \end{aligned}$$

5-6. Lighter Requirements

Once an average turnaround time is established, the number of lighters required to deliver an assigned daily tonnage can be computed by using the following formula:

Number of lighters required =

$$\begin{aligned} & \frac{\text{daily tonnage}}{\text{average tons per lighter}} \\ & \times \frac{\text{turnaround time in hours}}{\text{hours of operation daily}} \end{aligned}$$

5-7. Daily Tonnage Capabilities

In some cases, it will be necessary to forecast the amount of tonnage that can be transported by the available craft over a specified period of time under existing conditions. Daily tonnage capabilities are computed by using the following formula:

Daily tonnage capability =

$$\begin{aligned} & \frac{\text{hours per operational day}}{\text{turnaround time per lighter in hours}} \\ & \times \text{average tonnage per lighter} \\ & \times \text{number of lighters available} \end{aligned}$$

For sustained operations, plans should be based on an average availability of only 75 percent of the assigned craft. Therefore, the daily tonnage capability derived from application of the above formula must be reduced by 25 percent.

5-8. Control System

As previously pointed out, the operations of the lighterage companies must be responsive to the needs of the terminal service units handling the cargo at shipside and at the beach. In order to maintain the balance necessary for a smooth and continual flow of cargo over the beach, the lighterage unit commander must be constantly aware of the status and location of all his craft so that platoons, sections, and individual lighters can be relocated or assigned new or additional missions as rapidly as possible.

This flexibility of operation requires a responsive, *closely monitored control system*. Control is maintained primarily by means of radio communication and is exercised through a lighter control center and various control points located as required on the beach, at shipside, and in the discharge areas (for amphibians). The extent of the control system will depend on the size of the operational area, the dispersion required, the ship-to-shore distance to be traveled, and the type of lighter being employed. In average situations—particularly when working two ships simultaneously—best results will be obtained by decentralizing operations to platoon level. This approach reduces communication problems and simplifies overall control. The greater the dispersion, the more important decentralization becomes.

Under decentralized platoon operation and maximum dispersion, a typical control system would include a lighter control center, a shipboard control point on each ship being worked, a discharge control point (for amphibians), and one beach control point for each platoon. See FM 55-51 for further details on the operations of the control system.

5-9. Shipside Procedure

Loading cargo into a lighter from a vessel anchored in the stream is a difficult and sometimes dangerous operation. The shipboard control point noncommissioned officer must take into account the conditions under which the ship is being unloaded and must constantly supervise the lighter crews at shipside to guard against any unnecessary compromise of safety precautions.

If it is his opinion that it is dangerous to continue the discharge operation, he must immediately notify the lighter control center. The unit commander or lighter control center officer will then decide whether to continue operations or suspend them until conditions improve and will make his recommendations to the terminal battalion commander.

The ship discharge rate is influenced by the following factors:

- Type of cargo to be unloaded (mobile, containerized, unitized, or loose).
- Characteristics of the cargo ship.

- Handling gear available.
- Experience of the cargo handling personnel on the ship and ashore.
- Weather conditions.
- Distance of cargo ships from the beach.
- Beach characteristics.
- Distance of amphibian discharge points from the beach.
- Enemy air, ground, and naval action.

Unless unusual wind or tidal currents exist, the ship is normally anchored bow to either the wind or current, depending upon which is stronger. If all hatches are being worked, lighters must receive cargo over both sides of the ship. For example, the cargo from No. 1 hold may be discharged over the starboard side and that from No. 2 over the port side, etc.

In some cases, sea and weather conditions may be such that cargo discharge from a ship at anchor may be impractical. When this situation exists, the ship should be moored bow and stern to avoid swinging to the tide or wind and all lighters should be moored on the lee side of the vessel to receive cargo.

Lighter operators are instructed by beach control personnel or by the shipboard control point NCO as to the number of the hatch and the side of the vessel at which they should moor. Detailed procedures for coming alongside, mooring, and clearing shipside are contained in TM 55-501.

Drafts of nonunitized small items of cargo are usually handled in cargo nets which are unhooked and left in the craft. Empty nets are returned to the ship each time the lighter comes alongside for another load.

5-10. Use of Jumpers

Aboard the smaller lighters (LARC-V, LARC-XV, and LCM) all shipside cargo-handling operations are normally performed by crewmembers. However, in the event that one or more crewmembers are otherwise occupied in operating or maintaining their craft and cannot be spared for cargo-handling duties, a jumper system may be implemented to provide additional crewmen. This arrangement employs crewmen from deadlined or standby lighters to assist the regular crew, especially in the operations of positioning and securing cargo in the lighter for movement to the beach. When extra crewmen are not available from these sources, they may be provided by the terminal service company. Aboard larger lighters, such as LCU, the positioning and stacking of palletized or other unitized cargo is most expeditiously accomplished by a forklift that is provided and operated by the terminal service company. Because of the potential hazard that exists in any attempt to transfer personnel from one craft to another alongside the ship, men employed as jumpers and as forklift operators should board the lighter and debark from it at the beach.

5-11. Salvage Operations

The main objective of salvage operations is to keep the beach and sea approaches clear. Experienced salvage men never lose sight of this primary mission. They do not become so involved in freeing a single stranded or disabled craft that they impede beach or offshore operations. To keep the beach clear, craft that can be repaired or removed quickly are given priority. Boats that cannot be salvaged readily are anchored securely and left at the beach until traffic eases and more time can be devoted to them.

When a landing craft broaches to and is stranded, salvage crews must act quickly. Speedy assistance often prevents serious damage to boats, especially in heavy surf. Fast recovery from seaward is usually the best procedure for salvaging broached-to boats. Methods of recovery are given in TM 55-501.

When a loaded craft grounds offshore, any practical system that will expedite the unloading of cargo from the craft should be used. It may be possible for amphibians to moor alongside or at the lowered ramp so as to permit the transfer of small items of cargo by hand. Cargo in small, packaged containers up to about 40 pounds in weight can be handed over the side. Cargo boxes placed at the rail of the craft may serve as steps and facilitate cargo handling. Cargo that is too heavy to be moved by hand may be lifted by rough terrain crane. The crane is driven to the stranded craft if intervening depths and surf conditions permit.

A bulldozer may be employed effectively to push stranded craft back into the water. The blade of the bulldozer must be padded by fenders, salvaged tires, or similar material to prevent damage to the hulls or ramps of the craft.

No craft is ever left on the beach unattended or unwatched. The operator must remain constantly at the controls while beaching, loading, unloading, and retracting.

5-12. Antibroaching Measures

The best insurance against broaching to is an alert, skilled operator who knows the capabilities and limitations of the craft to which he is assigned. Normally, no attempt is made to use antibroaching aids if the craft is to be unloaded quickly and retracted from the beach immediately. Under most conditions, *antibroaching lines* from the bow or stern of the beached craft are impractical. In extreme surf conditions where broaching is most likely to occur and antibroaching lines are most needed, they are ineffective and are time consuming to install; moreover, they severely restrict the number of landing craft that can be accommodated at one time along a specific sector of the beach.

The master of an LCU keeps his craft in proper position on the beach by judicious use of engines, rudder,

and stern anchor. If LCU and LCM-8 are beaching on the same sector of a beach, some protection is afforded the LCM-8 if they are beached immediately leeward of the LCU. For example, if three LCU are on the beach, one or two LCM-8 can be beached and discharged in the partially protected zone on the lee side of each LCU. When LCM-8 and LCU are loaded with similar cargo, two or more LCM-8 can usually be unloaded in the time required to discharge an LCU.

Preventive and recovery procedures for broached-to craft are covered in TM 55-501.

5-13. Documentation

All cargo moving through water terminals is documented in accordance with DOD Regulation 4500.32-R (Military Standard Transportation and Movement Procedures (MILSTAMP)). The basic document for cargo movements under these procedures is DD Form 1384 (Transportation Control and Movement Document (TCMD)), which is used as a dock receipt, a cargo delivery receipt, an accountable document during temporary holding, and a record of all cargo handled.

Although cargo documentation is a function of the terminal service company, the commander of the lighterage unit must insure that all cargo received at the ship is properly accounted for until it is unloaded at the discharge point. This is accomplished by having the lighter operator receive at shipside copies of the TCMD covering the contents of his load. The number of copies furnished will depend on command requirements for each particular discharge operation.

The lighter operator retains one copy of the TCMD, all other copies having been delivered with the cargo to the terminal service shore checker at the discharge point. The retained copy is initialed by the shore checker to signify receipt of the cargo. At the end of the shift, the lighter operator turns in all initialed copies of the TCMD to the lighter control center. The information from these TCMD provides the lighterage company with data on cargo transported during each shift. For more details on use of the TCMD, refer to FM 55-16.

5-14. Beach Area Security

The terminal commander is responsible for local defense of his portion of the beach area. Commanders of all units have their normal responsibility for the security of men and equipment. Each unit is assigned a mission in the defense system, emergency assembly areas are designated, and an alert warning system is established. An overlay of the beach defense is circulated to all units in the area.

General security measures taken by lighterage units within their bivouac areas include—

- Dispersing all vehicles, equipment, and personnel.
- Posting guards, patrols, and sentries.
- Constructing foxholes, slit trenches, and dugouts.
- Designating specific defense positions for all personnel and conducting alert drills to insure that personnel are familiar with their duties in an emergency.
- Organizing definite defense groups under leaders specifically designated in a published defense plan.
- Organizing communication systems to be used during defense operations.
- Constructing obstacles to the advance of attacking forces.
- Planning for integrated fields of fire.

In an emergency all members of the lighterage units, including crews, may have to occupy defense positions. Accordingly, weapons must be kept handy at all times and frequently checked to insure that they are in serviceable condition.

Defense plans for beach areas will be coordinated with higher headquarters and integrated with the theater army rear area protection (RAP) plan and other exist-

ing base defense plans to insure mutual support. For a complete discussion of RAP operations, see FM 31-85. Normal passive and active security measures to protect the beach in the event of air attack are established and coordinated by the responsible terminal headquarters. These measures consist mainly of concealment, dispersion, early warning, and weapons firing. Shelters are provided for personnel, a system of alert warning signals is set up, and installations are camouflaged.

Military police protect (or advise on ways of protecting) beach areas against sneak attack, infiltration, and acts of sabotage and pilferage. Exposed as they are to the possibility of pilferage and sabotage, beach areas become even more vulnerable because the accumulation of supplies makes them targets for both enemy and criminal activities. When the threat confronting beach areas becomes a matter of concern, military police units may be required to increase the security posture of the area.



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CHAPTER 6

INLAND WATERWAY OPERATIONS

6-1. General

Inland waterways are normally used for military purposes in underdeveloped areas in which alternate modes are either lacking or insufficient. These waterways are used principally for civilian traffic and for restoration of the local economy. It is assumed that rehabilitation of inland waterways will be undertaken by local authorities and that a minimum of military effort will be diverted for the purpose, except where designated for immediate military use and equipment salvage.

Two advantages of using inland waterways as a transportation mode are the ability to move large quantities of volume cargo and the relative ease of movement of large, heavy, or outsize loads.

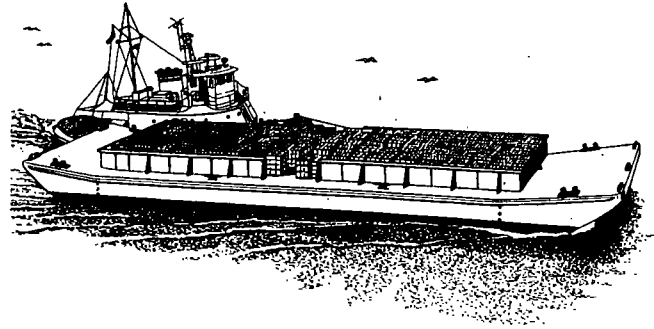
Disadvantages include the slow movement of the carrier, the vulnerability to sabotage and enemy action, weather and seasonal interruptions such as flooding and freezing, location restrictions on direct movement of supplies either forward or laterally, and requirements for rehandling at a terminal or a transfer point because of shipment diversions. For these reasons, inland waterway capability is incorporated into the transportation service only when sufficient transport capability cannot be provided by other modes.

6-2. Organization of an Inland Waterway Service

When required, an inland waterway service may be formed to control and operate a waterway system, to formulate and coordinate plans for using inland waterway transport resources, and to provide for integration and supervision of local civilian facilities used in support of military operations. This organization may vary in size from a single barge crew to a complete inland waterway service, depending upon the requirements. It may be composed entirely of military personnel or may be manned by local civilians supervised by military units of the appropriate transportation staff section.

Inland waterway units are normally a part of the theater army transportation intersectional service, but they may be assigned to the corps support command (COSCOM) if the inland waterway operation takes place wholly within the COSCOM area of responsibility.

Although an inland waterway service may be operated



by a terminal group, a terminal battalion composed of appropriate terminal service, terminal transfer, harbor craft, boat, and/or amphibian units will most often be employed in this capacity.

6-3. Characteristics Affecting Inland Waterway Capacity

When evaluating the ability of an inland waterway to support a waterway movements operation, the waterway characteristics listed below must be considered. These characteristics will sometimes restrict the type and number of lighters that can be efficiently operated on a given waterway.

- Restricting width and depth of channels.
- Vertical and horizontal bridge clearances.
- Location of dams or other bars to navigation.
- Location, dimensions, and timing of locks.
- Frequency and duration of seasonal floods and droughts.
- Normal freezeup and opening dates.
- Hazards to navigation, such as rapids and falls.
- Speed and fluctuation of currents.
- Waterway maintenance requirements.
- Shifting of channel location.

6-4. Considerations Affecting Watercraft Requirements

The majority of inland waterway operations involve the movement of cargo from an ocean terminal to an inland discharge or transfer point that is not accessible by deep draft ships. If the cargo is delivered to the ocean terminal in preloaded barges or lighters carried aboard ship (LASH or SEABEE), the principal requirement for Army watercraft is for tugboats to move the preloaded barges to the inland discharge terminal and return the empty barges to the ocean terminal for loading aboard ship. When cargo is to be moved by tug assisted barges, the barge-to-tug ratio of tows will vary depending upon the type of ocean terminal operation and the type of waterway.

• Open waterways can generally accommodate a large volume of traffic. The Mississippi River is an example of such a waterway. Commercial tows on the lower Mississippi may consist of as many as thirty barges propelled by one tow boat and measure as much as a

quarter of a mile long. Operation in an open waterway permits a greater barge-to-tug ratio than would be possible in a restricted waterway.

•An inland waterway that has locks or other restrictive features such as narrow bridge spans or a narrow channel is a restricted waterway. When operating in this type of waterway, the number of barges in a tow must be restricted to enable the tow to negotiate the restrictive features. This will generate a requirement for a greater tug-to-barge ratio than would be required in an open waterway.

6-5. Estimating Lighterage Requirements

The following formula is used to compute the number of barges or other lighters required to move a given daily tonnage for a sustained period of time:

$$\begin{aligned} \text{Number of barges required} &= \frac{\text{daily tonnage}}{\text{average tons per barge}} \\ &\times \frac{\text{turnaround time in hours}}{\text{hours of operation daily}} \end{aligned}$$

Example: Determine the number of barges (585 = long-ton capacity) required to move 1,000 short tons of palletized cargo daily a distance of 60 miles forward, assuming that there will be no lost time in locks, that current effect will be negligible, and that the barges will be loaded to an average of 60 percent of their rated capacity. The average loading and unloading rate per barge is 15 short tons per hour, and travel speed is 4 miles per hour. On the basis of these figures, the barge requirements are computed as follows:

$$\frac{2 \times 60 \text{ miles}}{4 \text{ mph}} = 30 \text{ hours round trip travel time per barge}$$

$$585\text{-long-ton capacity} \times 60 \text{ percent} = 351 \text{ long tons per barge}$$

$$351 \text{ long tons} \times 2,240 \text{ pounds} = 786,240 \text{ pounds}$$

$$786,240 \text{ pounds} \div 2,000 \text{ pounds} = 393.1 \text{ average short tons per barge}$$

Loading and unloading time per barge

$$= \frac{2 \times 393.1 \text{ short tons}}{15 \text{ short tons per hour}}$$

$$= 52.4 \text{ hours}$$

Turnaround time per barge (para 5-5)

$$= 30 \text{ hours} + 52.4 \text{ hours}$$

$$= 82.4 \text{ hours}$$

Then

$$\frac{1,000 \text{ short tons daily}}{393.1 \text{ short tons per barge}} \times$$

$$\frac{82.4 \text{ hours turnaround time}}{20 \text{ hours daily operation}}$$

$$= 2.54 \text{ barges per day} \times 4.12 \text{ operational days}$$

$$= 10.46 \text{ or } 11 \text{ barges required for sustained operation}$$

Note. When the operation involves preloaded barges or lighters shipped aboard SEABEE or LASH ships, the barge loading should not be included in the computation.

CHAPTER 7

AMPHIBIOUS OPERATIONS

7-1. Concept of Employment

When employed in amphibious operations, Army landing craft and amphibian units are initially attached to and train with the unit providing shore party support to the landing force (FM 5-144). When the shore party is dissolved upon termination of the amphibious operation, the water transport units are attached to a terminal battalion or a terminal group for participation in subsequent logistics over-the-shore (LOTS) operations.

Normally, Army and Navy landing craft and the landing vehicles, tracked (LVT), of the engineer amphibian assault companies (FM 5-144) deliver the assault waves ashore. The wheeled amphibians are employed as floating dumps for on-call supply movement and are used in the followup general unloading phase after the beachhead has been secured.

Information on amphibious operations beyond that given in this chapter may be found in FM 31-11 and FM 31-12.

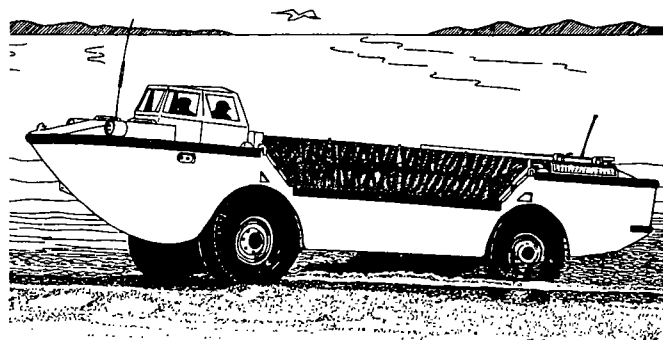
7-2. Planning

Planning for operational employment and coordinated training with shore party elements begins immediately upon receipt of the initiating directive assigning a water transport unit to the landing force. Liaison is established between the water transport unit and the engineer amphibious unit to which it is attached. During the planning phase, the water transport unit commander makes detailed plans corresponding with those of the other elements of the shore party and/or landing force. These plans should provide for—

- Shore-based and afloat training.
- Missions and operational assignments.
- Organization for embarkation and landing.
- Ship-to-shore movement procedures.
- Subsequent employment after accomplishment of primary mission.
- Supply and maintenance.

The unit commander takes into consideration those factors cited in paragraph 5-3 when selecting (or providing advice to the shore party commander on the selection of) specific beaches and/or beach areas for the employment of his craft.

During the planning phase, water transport units require extensive individual training, as well as training with other elements of the landing force in amphibious



techniques to insure efficient execution of their support mission. Continual practice in the mechanics of attaining coordination is necessary during training to achieve virtually automatic execution during the operation.

7-3. Embarkation

Lighterage is transported to the objective area aboard landing ships and/or assault ships. Types and numbers of lighters to be carried by each ship of the transport group are determined individually by hull number through coordination between representatives of the landing force and the appropriate naval transport echelon.

Before arrival of assault shipping, water transport unit commanders, troop commanders, naval commanders, and the shore party commanders concerned prepare detailed landing and embarkation plans for the lighters based on overall tactical plans and the scheme of maneuver ashore. Details of embarkation planning are contained in FM 60-30.

The senior water transport unit representative to be embarked on each ship, along with the commanding officer of troops and the ship's combat cargo officer, arrange for the following:

- Assignment of billets.
- Assignment of crews, relief crews, and maintenance teams.
- Assignment of working parties.
- Storage of fuel, lubricants, and maintenance material to insure availability en route and during the initial stages of the assault.
- Organization of security details.
- Messing procedures.
- Stowage of weapons and ammunition.

All supplies and repair equipment must be prepared for loading before the assault shipping arrives in the embarkation area. A final inspection must be made to insure that all craft and equipment are in proper condition and are ready for the operation. All lighters should be completely serviced, with fuel tanks and water cans filled, accessories in place, and radio and navigation equipment waterproofed. This inspection should also include an examination of the cargo loaded

aboard each craft to insure that it is securely lashed and adequately protected.

Water transport units should be ready to begin loading immediately upon arrival of the ships in the embarkation area. If ships are to be loaded offshore, the embarkation area should be so organized that amphibians and boats use different beach areas. Lighters to be embarked aboard each ship are grouped together and escorted by naval guide boats to the assigned ships.

Craft must be loaded aboard assault shipping in a manner that will permit debarkation in the proper order when they arrive in the objective area. The loading sequence is the responsibility of the officer in charge of the craft assigned to each ship.

7-4. Operations

As noted previously, Army amphibian units other than engineer amphibious units normally do not land with the initial assault waves. These elements, however, must be debarked and deployed in a timely manner so that they can sustain the assault forces by facilitating the landing and forward movement of supplies and supporting equipment.

The assault elements land initially with only a portion of their supporting units, equipment, and supplies. The remainder must be unloaded, brought to the beach, and forwarded as rapidly as possible to the using unit on a predetermined schedule.

In amphibious operations, ship-shore movement is under Navy control exercised by naval control officers aboard Navy control ships. Near-beach movement control is a responsibility of the shore party and is carried out through attached naval beach parties. Available ship-to-shore means of all types are used to accomplish rapid buildup of combat power ashore without congestion on the beach.

During the period immediately following the landing of the initial waves, the lighters designated as floating dumps and on-call elements are debarked and stationed at designated control points. The water transport unit commanders remain waterborne throughout this period, assisting naval control officers in dispatching and routing craft and coordinating maintenance and supply activities for their units.

When dispatched ashore by the naval control officer, the craft move to the designated beach. After the cargo is unloaded, they move to assigned assembly areas where they are routed to a specific ship for reloading. Unit craft continue to function in this manner throughout the initial and general unloading periods until released by the naval control officer or the shore party commander, at which time they revert to the control of their parent organization (terminal battalion or group.).

When the general unloading period begins, the water transport unit commanders normally move ashore,

along with their control elements, to facilitate coordination with the shore party commander and with the staff of the terminal battalion being phased ashore. Once ashore, they establish company command posts and set up shore-based control systems.

7-5. Beach Markers

During the process of organizing the beach for the reception of landing craft, landing ships, and amphibians, a system of beach markers is instituted. The markers assist the vessel operators in locating the correct beach in daylight or darkness. The markers are installed by the shore party personnel as soon as possible after the initial assault of an amphibious operation has been made.

Beaches under attack are given a color designation such as Red Beach or Green Beach with markers of corresponding colors. The daylight markers are constructed of cloth and held aloft as shown in the left portion of figure 7-1. During daylight, the left flank of a beach, as seen from the sea, is identified by a horizontal rectangle, the center of the beach by a square, and the right flank by a vertical cloth rectangle. During night operations, a system of white and appropriately colored lights is used as shown in figure 7-1.

When the tactical plan dictates that a number of beaches be used, each colored beach may be further divided into "beach number one" and "beach number two," etc. When the colored beaches are divided in this manner, the markers are erected in pairs, as shown in the right portion of figure 7-1.

7-6. Unloading Point Markers

To permit rapid identification of and access to supplies required to support the landing force, selected classes of supplies are segregated by commodities as they are unloaded from lighters at the beach area. To enable the landing craft or amphibian operator to identify the appropriate beaching or unloading point for the class of cargo being carried, markers showing supply symbols (and lights for night operations) are erected on the beach facing toward seaward. Examples of these types of markers are shown in figure 7-2.

7-7. Hydrographic Markings

Hydrographic markings such as those shown in figure 7-3 have been developed for use near shore in areas not otherwise suitably marked. The shore party commander is responsible for determining the necessity for hydrographic markings and for installing them. These markings have no relation to the aids to navigation maintained by the Coast Guard. See TM 55-501 and FM 55-15 for a description of navigational aids and the US buoyage system. During the day, a pennant with alternate red and black vertical stripes is fastened to a buoy or stake to show the location of

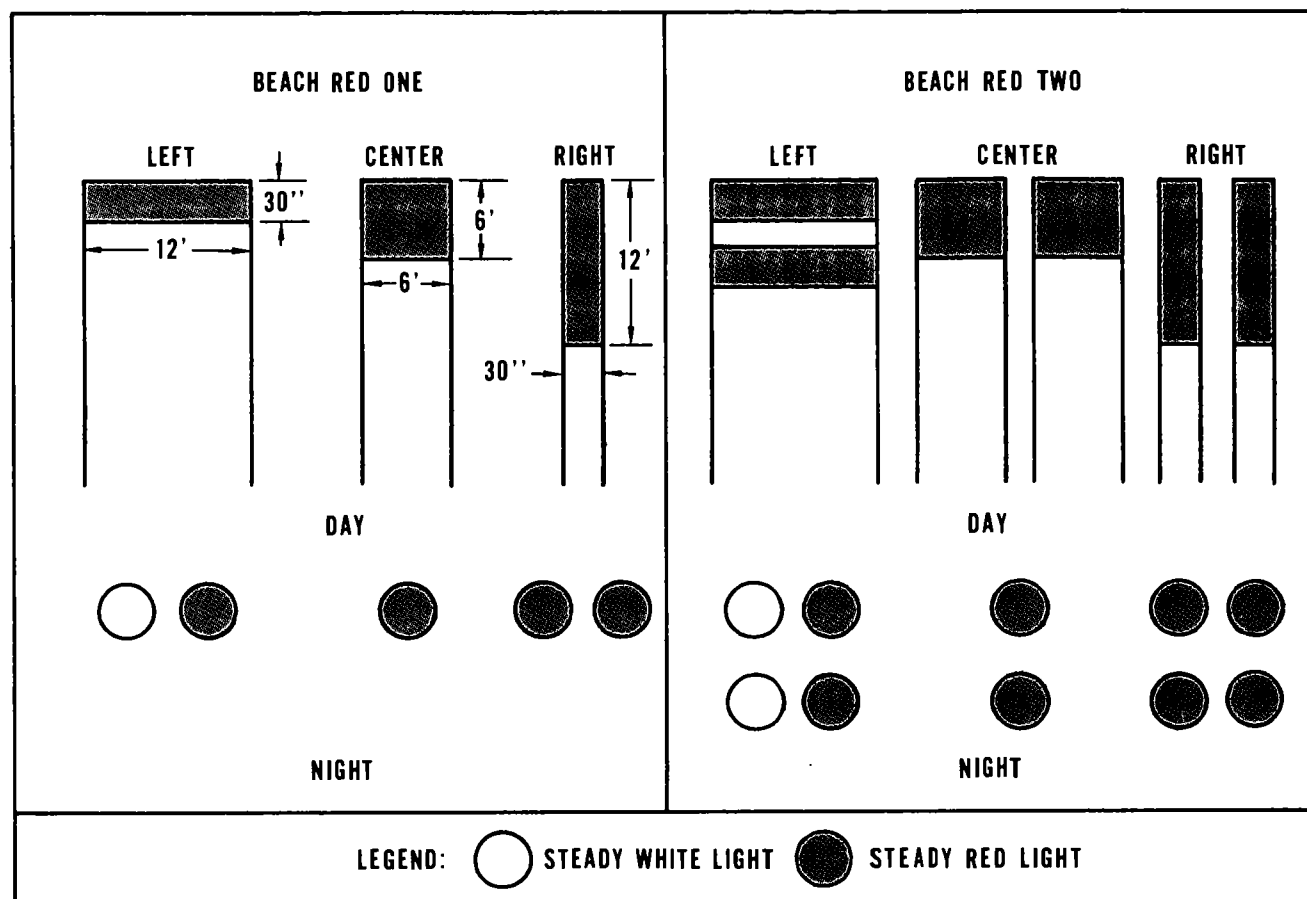


Figure 7-1. Beach markers (from seaward).

rocks, shoals, or submerged obstacles. The pennant is replaced at night by a white light above a red light, both blinking. Hydrographic markings for channels consist of the following:

- A black pennant by day and a blinking white light by night mark the port side of the channel for craft coming from seaward.
- A red pennant by day and a steady red light at night mark the starboard side.
- A black and white vertically striped pennant by day and a blinking green light at night mark the center of the channel or fairway, which is the area between the port and starboard sides of the channel.

7-8. Range Markers

Two lights or markers located some distance apart and visible usually in one direction only are known as range lights or range markers. They are located in tandem in line with the center of the channel or the center of the beach and, when the operator positions his craft so that the range markers appear one over the other, the craft will be on the axis of the channel or on the proper heading to arrive at a designated point on the beach. Characteristics of established ranges are

indicated on the hydrographic charts for the particular area.

When ranges are constructed especially for beach operations, an explanation of their purpose and use is provided to lighter operators in advance. Ranges should be used only after careful examination of the charts or complete instructions from the water transport unit commander. It is particularly important to determine the distance that a range line can be safely followed. The shore party commander is responsible for establishing ranges and installing range markers.

7-9. Communications

The physical conditions in amphibious operations require almost complete dependence on radio communication during the initial landings and the initial unloading period. Because of the large number of radios available in landing force craft and vehicles and with the combat elements, strict adherence to sound signal security practices is essential (FM 32-5 and FM 32-6). Because of this complexity, wire communication should be established between shore installations as early as possible.

During the initial phases of the operation, control of

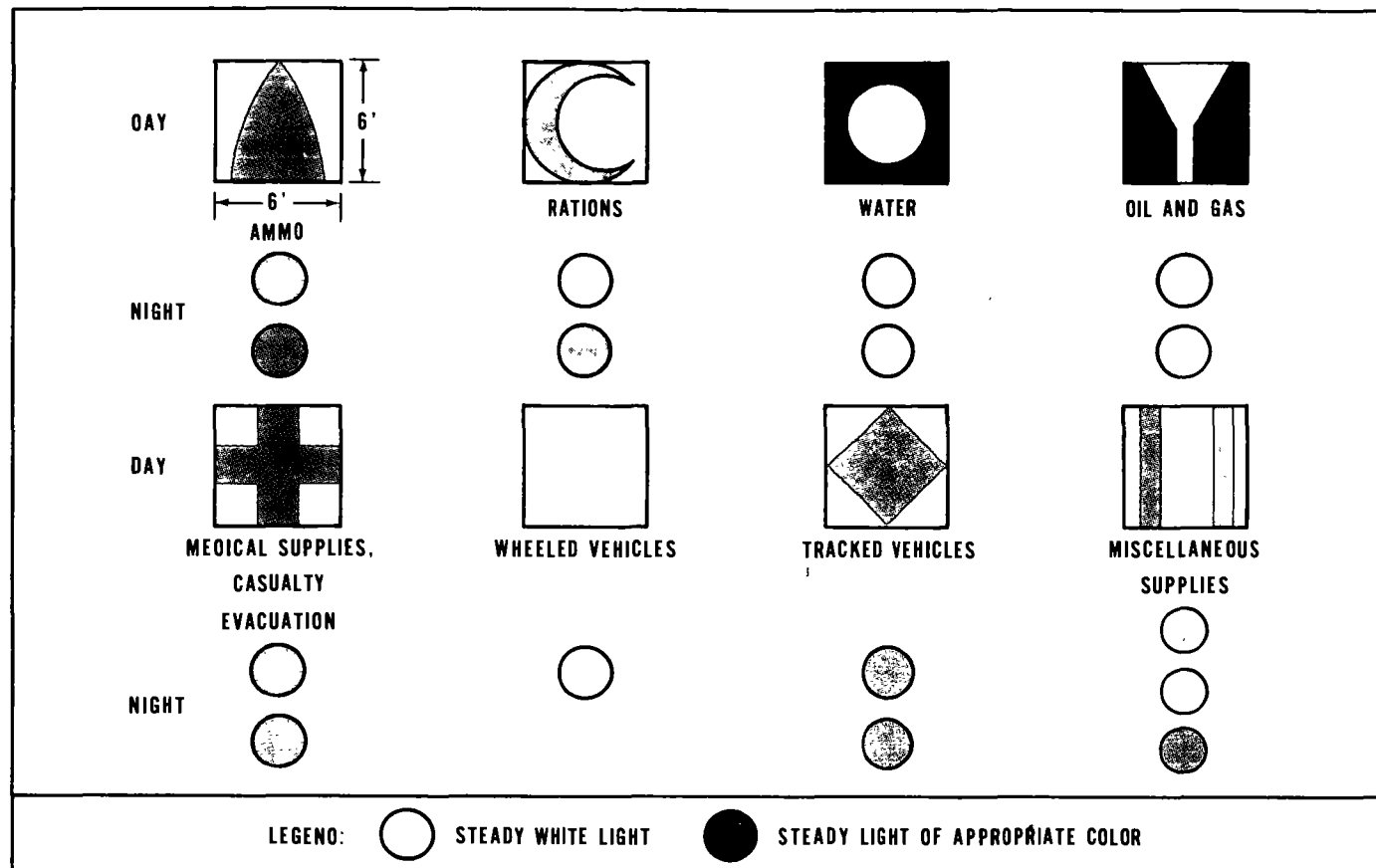


Figure 7-2. Unloading point markers.

the lighters afloat is exercised by the naval control system and control ashore by the shore party control system; communication between elements of the water transport units and company headquarters is virtually nonexistent. However, the initial intracompany communications net must be ready to function as soon as the unit control system is established ashore. This net and the control procedures for its use must be provided for during the planning phase.

7-10. Maintenance Support

During the actual conduct of an amphibious operation, floating craft maintenance support will be provided only by unit maintenance sections and direct support teams. Direct support and general support companies (chap 10) will not be phased in until the situation ashore is completely stabilized.

Every effort must be made to establish organizational and direct support maintenance personnel and equipment ashore as soon as practicable so that delivery of supporting personnel and supplies will not be seriously impaired by an insufficient number of operational lighters.

During the early phases of the operation, floating contact maintenance teams and salvage craft should be provided to aid disabled craft in transit between the shore and the assault convoy. These teams are made up of personnel from the organizational maintenance sections and from the direct support teams detached from the lighterage direct support company. Preoperational plans must include designation of amphibians, landing craft, and/or small harbor craft to provide floating bases for these teams.

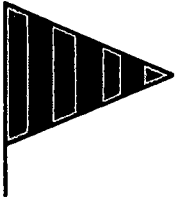
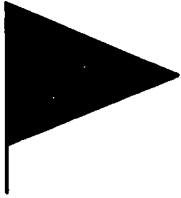
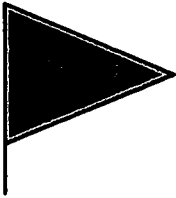
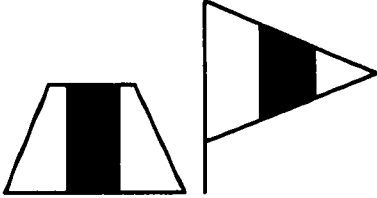
	ROCKS, SHOALS, AND OBSTRUCTIONS	PORT	STARBOARD	FAIRWAY OF CHANNEL
DAY				
NIGHT				
LEGEND:  STEADY LIGHT  BLINKING LIGHT				

Figure 7-3. Hydrographic markings for beach operations (from seaward).



CHAPTER 8

SHORE-TO-SHORE OPERATIONS

8-1. General

Water transport units may be called upon to support combat forces conducting shore-to-shore assaults and to ferry cargo across or along rivers and between islands in routine resupply operations.

Except for the fact that shipping is not involved, the operational techniques for water transport units in logistical and tactical shore-to-shore operations are identical to those described in chapters 5 and 7, respectively. However, because of the nature of the terrain and the differences in control requirements, some basic planning considerations for shore-to-shore operations, and particularly for river crossings, are covered in this chapter. Further details on river crossings and other shore-to-shore operations are contained in FM 31-60 and FM 5-144.

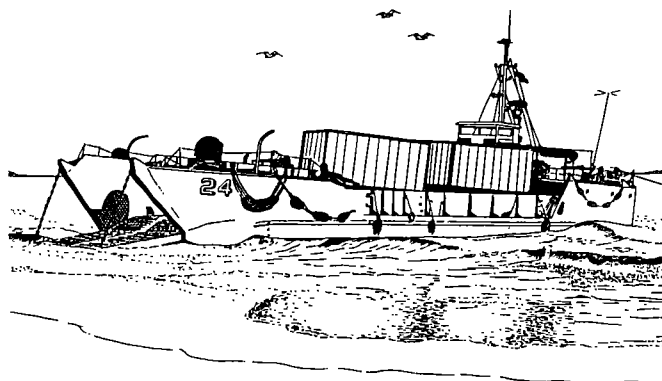
Although in a tactical shore-to-shore operation the water transport unit commander does not have the final choice in the selection of a landing site, he should advise the tactical commander of his requirements as to specific areas and should indicate any conditions that would adversely affect the operational efficiency of his unit. In a shore-to-shore logistic (LOTS) operation, there is normally sufficient time to make the necessary preparations at the site to insure the success of the mission. In general, the site selection factors described in paragraph 5-3 must be considered in evaluating areas for shore-to-shore operations. An additional factor to be considered in river crossing operations is that crossing sites must be located downstream from bridge sites to reduce the possibility of bridges being damaged by disabled craft and floating debris.

8-2. Control

In average situations, lighterage units in shore-to-shore LOTS operations normally require the following control points:

- Lighter control center.
- Loading area control point.
- Near-shore beach control point.
- Far-shore beach control point.
- Discharge control point.

These points will operate in the same manner and fulfill the same functions as outlined in paragraph 5-8, with the loading area control point replacing the shipboard control point and a beach control point being



added on the far shore. In some cases it may be expedient to move the lighter control center closer to the waterline and eliminate the beach control point on the near shore.

8-3. Assembly Areas

Whenever possible, the commander of the supported unit should consult the commander of the water transport company before designating assembly areas to be used in a shore-to-shore operation. Among the desirable characteristics of an assembly area are the following:

- Location as near as practicable to the crossing site.
- Easy entrance from the rear and good exits to the crossing site.
- Sufficiently large to permit dispersion of lighters and to provide an adequate loading area.
- Defiladed to the degree necessary to permit assembly and maneuver without enemy observation.
- Terrain firm enough to permit the passage of amphibians without the use of excessive power and its accompanying noise.

8-4. Riverbanks

Planning for river crossings requires careful consideration of the characteristics of the body of water to be crossed.

The slope of each bank must not be more than 40 percent (40 feet of rise for each 100 feet of forward horizontal distance), and preferably should be less. In addition, the slope should be gradual without an abrupt dropoff at the water's edge. During operations, amphibians should use multiple routes into and out of the water to avoid the formation of deep ruts that would cause the craft to "belly" down. Earthmoving equipment may be used to decrease the slope of high banks and to level off entrances and exits.

Consideration must also be given to the type and consistency of the soil at the crossing sites. Marshy, swampy areas and soils with a clay base must be avoided. When hard-packed sand entrances and exits are not available in the operational area, pierced steel planking, brush, netting, etc., may be used to increase traction. Earthmoving equipment may be used to im-

prove the trafficability of the entrance and exit routes at the crossing site.

8-5. River Bottom

A sandy shoreline with a gradual slope; clear, deep water; and a clear river bottom provide ideal conditions for a crossing site, but these conditions are not often encountered in the field. Mud is the most difficult terrain to cross in an amphibian, and this is the type of soil usually found in and around rivers. Shallow rivers with soft bottoms are particularly difficult for these craft. If the river is too shallow to float an amphibian, the wheels will sink into the muddy bottom and immobilize the craft, increasing the danger of its capsizing in swift currents. A shallow river with a bottom made up of large rocks presents similar problems for amphibians. These conditions can sometimes be remedied by using underwater bridges constructed of sandbags.

8-6. River Currents

Operation in rivers with swift currents (more than 4 miles per hour) requires highly skilled and experienced operators. When exceptionally swift currents are encountered, it may be possible to rig a cable from

one bank to another to assist craft in crossing.

When it is impossible to make a cable crossing, amphibians should be backed into the stream so that the rudder and propeller will enter the water at the earliest possible time and give the operator maximum control of his craft. This approach also causes the stern to float first so that it will swing around and head the bow into the current as the craft becomes waterborne.

8-7. Obstacles

It is unlikely that obstacles will be encountered in the center of the river, but banks may be mined with conventional antitank, antipersonnel, or chemical mines, and anti-amphibious mines may be laid below the high waterline. Early reconnaissance by the tactical unit should disclose the location of minefields in the area of operations so that they can be removed or avoided during crossing.

Personnel of the water transport unit must be trained to be on the lookout for mines and to mark and report their location. Naval mines probably will not be encountered in river crossing operations unless the river is of sufficient depth for navigation by seagoing vessels. However, crewmen must be on the alert for floating mines of the type used for bridge destruction.

CHAPTER 9

RIVERINE OPERATIONS

9-1. General

In developing areas with limited land transportation and abundant water surface, inland waterways provide natural routes for transportation and are logical centers of population. In some developing countries, inland waterways are major arteries for economic circulation. River transportation of local products may necessitate military operations to keep waterways open and, in some instances, to transport local produce to maintain the local economy.

Water routes have strategic and tactical importance to an insurgent or enemy force, particularly in situations where an external aggressor supports and directs insurgency. Such a situation dictates a doctrine and strategy of interdiction and control of waterways. Operations involving this doctrine are known as riverine operations.

A detailed explanation of this doctrine is contained in FM 31-75; the material in this chapter is introductory in nature to provide water transport commanders and personnel with a perspective for riverine operations.

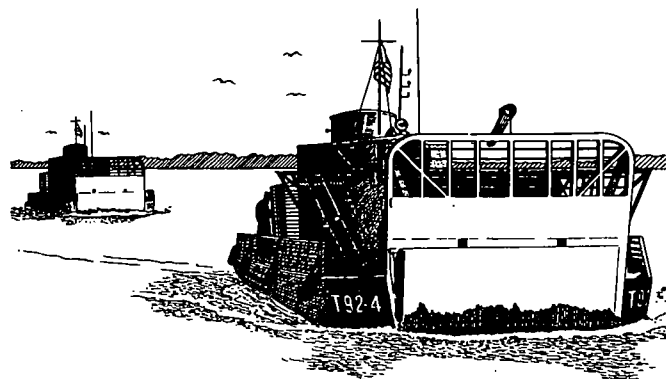
9-2. Riverine Environment

A thorough understanding of a riverine environment is necessary to plan and conduct riverine operations. In a riverine area, watercraft are the principal means of transport. The people settle along waterways, often the only lines of communication. Civilian traffic and settlements conceal the enemy's movements and help to conceal mining and ambush operations. Control of waterways is necessary to establish and maintain control in riverine areas.

A riverine environment is dominated by water lines of communication, possibly several major rivers and tributaries or an extensive network of minor waterways, canals, and irrigation ditches. Military movements use air and water transportation extensively because of the lack of a suitable road net. Suitable land for bases, airfields, and artillery firing positions may not always be available because of the topography, location of the civilian population, restrictions on withdrawing land from agricultural use, or a combination of these factors.

9-3. Organization and Command

Riverine operations are joint operations undertaken primarily by Army and Navy forces and require the



coordinated and integrated efforts of participating forces to achieve a common objective. Department of Defense and Joint Chiefs of Staff directives prescribe joint forces command arrangements to insure coordination and integration. Joint command organizations provide for central direction to coordinate the efforts of the forces committed, decentralized execution to accommodate the detailed action of a large number of commands or individuals, and common doctrine among the forces involved. The organization is flexible to insure control and coordination of these forces in varying operational environments.

Mission, enemy, terrain and weather, and troops available are the bases for the task organization. Riverine operations require a balance between types of forces, considering the total forces available.

A special consideration in task organization for riverine operations is the amount of troop lift and fire support available from Navy, Army aviation, and Air Force units. The major factors determining naval support requirements are—

- The extent to which navigable waters will permit movement of naval support to, within, and around the area of operations.
- The size of Army forces needed in the objective area, the availability of other means, and the desirability of using other means to deliver them.

9-4. Security Responsibilities

The relationship between Army and Navy elements stationed on a land or an afloat base is one of coordination and mutual support. The Army and Navy elements assign their appropriate share of forces for local base defense as the base commander directs. The primary mission of the Navy force in base defense is provision of gunfire support and protection against any threat from the water.

During tactical operations, the Army commander is responsible for providing security elements (ground or air) along the route of the movement, to include movement to contact and withdrawal to base areas. The Navy element commander exercises tactical control of the movement and maneuver of watercraft

under the operational control of the Army commander being supported.

The senior Navy commander embarked is in tactical control while the afloat base is en route from one anchorage to another. Higher headquarters normally directs or approves the relocation of the afloat base. Recommendations to the afloat base commander and to the senior Navy commander of the riverine force form the basis for decisions to relocate the afloat base. The Navy commander of the riverine force is responsible for the movement of Navy ships and watercraft between riverine bases and support facilities outside the riverine area. The Army commander in the riverine area is responsible for the security of movement of these ships within the area.

9-5. Concept of Waterborne Operations

Units conducting riverine operations use water transport extensively to move troops and equipment throughout the area. Waterborne operations normally start from areas where ground forces and watercraft marshal and load and where forces can effect coordination. This may be at a land base adjacent to a navigable waterway, at an afloat base on a navigable waterway, or in an existing area of operations. Once troops are aboard, the watercraft proceed to designated landing areas within an assigned area of operations for offensive operations.

Unit plans include control measures, such as phase lines and checkpoints, for the entire operation. The commander controls the unit's movement either from a command and control boat located within the movement formation or from an airborne command post. Maneuver unit commanders embarked in command and control craft dismount from these craft to influence the action of their units.

The withdrawal of troops from the area of operations is a tactical movement back to the watercraft loading areas. Units are loaded in reverse sequence to that used in the waterborne assault landing. Security of the loading area is necessary throughout the withdrawal operation. A tactical water movement back to base areas or to another area of operations follows the loading.

9-6. Preparation for Waterborne Operations

Waterborne operations require detailed planning at all levels and close coordination with a supporting naval river assault squadron. Units conducting waterborne operations must be ready to begin the operation as soon as possible after receiving orders. Boat operators require training in operation, maintenance, and navigation. As a minimum, training consists of briefings in the marshaling or staging area to acquaint Army personnel with embarkation and loading procedures, required action during the water movement, and debarkation and landing procedures.

9-7. Planning for Waterborne Operations

Plans for waterborne operations must be detailed enough to give all participating units complete information, but simple and flexible enough to be modified as the tactical situation changes.

Plans for a waterborne operation are usually developed in the following sequence:

- *Scheme of maneuver* based on the mission, troops available, and intelligence concerning the enemy force and terrain, to include withdrawal.
- *Assault plan* based on the scheme of maneuver.
- *Water movement plan* based on the assault plan and the scheme of maneuver (the water movement plan includes composition of the waterborne force, organization of movement serials, formation to be used, movement routes, command and control measures, mine countermeasures, plans for fire support, and immediate reaction to ambush).
- *Loading plan* based on the water movement plan, the assault plan, and the scheme of maneuver.
- *Marshaling plan*, when required, based on the loading plan, the water movement plan, the assault plan, and the scheme of maneuver.
- *Deception plan*, when required, based on the mission.

9-8. Conduct of Waterborne Operations

Units are trained and prepared to conduct waterborne operations on short notice. Standing operating procedures (SOP) are kept current by applying lessons learned in previous waterborne operations. Training and adequate unit SOP allow marshaling activities to focus on the pending tactical operation.

Units complete preparation for the tactical operation, move to their loading areas, and load onto assigned watercraft in accordance with the water movement table and information in the watercraft loading table. Bulk supplies and ammunition are transported to the loading site and loaded and lashed in designated watercraft. Since several units may use the same loading site, loading must be completed and watercraft moved to their assigned rendezvous area according to the time schedule in the water movement table.

All water movements outside base areas are tactical moves. They are similar to the approach march of a movement to contact in ground operations where speed of movement and security of the formation are essential. The intent of the operation is to move directly to the objective; however, the unit is prepared for combat at any point along the movement route. The terrain and the enemy situation normally require an advance guard, flank guards, and a rear guard to protect the main body during the movement.

9-9. Waterborne Withdrawal

During preparation for the waterborne operation,

planners determine the availability of waterways in the area of operations, tide and current information for the scheduled period of the operation, and suitable loading sites. This information, kept current during the operation, provides the basis for planning the waterborne withdrawal.

Active employment of watercraft during offensive maneuver simplifies deception in the initial stages of a waterborne withdrawal. The quantity of hydrographic information available increases as a result of this employment.

When possible, waterborne withdrawal is timed to allow watercraft to approach loading areas with the current on the rising tide, to load during slack high

water, and to depart with the current on the falling tide.

Because of the security problems that accompany large waterborne movements and the use of predictable routes, loading during the last hours of daylight and moving under the concealment of darkness should be considered. Moving reconnaissance elements along possible withdrawal routes several hours ahead of the movement group is a useful deceptive measure.

Loading, normally the most critical phase of the withdrawal, requires detailed planning in the selection of troop assembly areas, loading areas, loading control measures, and watercraft rendezvous areas.



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CHAPTER 10

MAINTENANCE SUPPORT

10-1. General

Maintenance and repair of floating craft used in water terminal operations poses problems and requires arrangements which are somewhat different from those for other types of equipment. Except for amphibians—which can move inland for maintenance work—maintenance and repair facilities for landing craft and other floating equipment must be located afloat or near the water's edge. This may also influence the location of units and facilities for the maintenance and repair of other equipment used in terminal areas. Maintenance categories for watercraft are—

- Organizational maintenance—performed by operating crews and using-unit maintenance section.
- Direct support maintenance—normally performed at battalion or group level.
- General support maintenance—normally performed at group or brigade level.
- Depot maintenance—performed by commercial contracts or interservice support agreements.

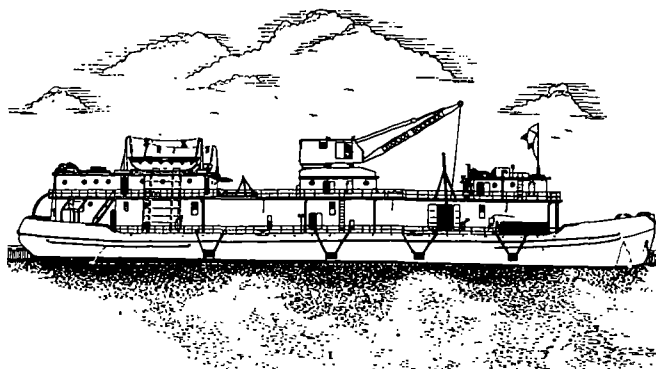
These categories are described in detail in AR 750-1. In addition to fulfilling maintenance functions assigned by the appropriate maintenance allocation charts, each support level provides support for the next lower level by handling overflow work which would normally fall within the responsibility of the latter but which cannot be completed because of time restrictions.

The principle of performing maintenance at the lowest possible level consistent with the personnel, skills, tools, repair parts, and time available also applies to watercraft and, when required by operational conditions, lower level units may be authorized to perform higher level maintenance tasks by the unit assigned primary responsibility for those functions.

The maintenance system must remain flexible to prevent overflows as much as possible and to provide procedures and facilities for absorbing these excesses when they do occur so that they will not continue to pile up, thus creating bottlenecks.

A responsive maintenance system is maintained by close liaison between operating units and their maintenance support units. In order to provide a firm basis for support planning and to insure sufficient watercraft availability, maintenance unit commanders must be informed of all actual and anticipated operational changes and there must be a constant exchange of capability information between maintenance support units.

Direct support maintenance units emphasize repair of



end items by replacement of unserviceable components, assemblies, and modules, with the repaired end items being returned to using units and the unserviceable components, assemblies, and modules being evacuated to or exchanged with a general support unit. General support maintenance is accomplished to permit return of an item to the user in accordance with maintenance standards established for each item of equipment.

For general planning purposes, it can be assumed that approximately 50 percent of all theater watercraft maintenance will be accomplished at organizational level (this includes daily maintenance and before-, during-, and after- operation service), 30 percent at direct support level, and 20 percent at general support level. Under average circumstances, the maintenance time ratio for watercraft will be approximately 1 hour of maintenance for every 3 hours of operation.

Technical assistance may be requested by supported units at any time, but should be provided on a regular basis without request to insure more effective and efficient user maintenance and to reduce demands on the supporting unit, thereby increasing its mission efficiency. Technical assistance consists of furnishing instruction and technical guidance to supported units by providing information on new maintenance and supply techniques and procedures and new publications and by providing guidance in implementing maintenance directives and orders. Detailed guidance relating to maintenance technical assistance is provided in AR 700-4 and FM 29-39.

10-2. Staff Supervision

A marine engineer technician (warrant officer) on the terminal battalion staff is responsible for staff supervision of organizational and direct support maintenance for marine equipment in the attached companies. He is additionally responsible for staff supervision of general support maintenance if this function is assigned at battalion level. This officer supervises correct recording of maintenance activities within the battalion in accordance with existing directives and conducts periodic inspections as necessary. He prepares reports of inspection, disseminates technical in-

formation, and provides technical maintenance assistance when required.

A marine maintenance officer is provided on the staff of the terminal group and terminal brigade to exercise staff supervision over general support maintenance functions for the command. The commanders of the attached general support units act as special advisers on floating craft maintenance to the marine maintenance officer and to the terminal group and brigade commander.

10-3. Organizational Maintenance

Organizational maintenance consists of that maintenance normally performed by a using organization on equipment in its possession. It includes maintenance and repairs that are within the capabilities of authorized personnel, skills, tools, and test equipment. Maintenance exceeding the authorized scope may be performed when specifically permitted by the next higher maintenance support commander.

With the exception of those craft that have engineroom personnel assigned as part of the crew, operator maintenance of watercraft is largely limited to proper operation and before-, during-, and after-operation checks to detect incipient defects. Therefore, the bulk of the organizational maintenance workload falls to the unit maintenance section, which is responsible for and capable of performing all the organizational maintenance functions indicated in the maintenance allocation chart published for each type of craft.

Watercraft unit capabilities are based on an average availability of 75 percent of the assigned craft. A constantly supervised operator and organizational maintenance effort is required to sustain this rate. When maintenance at this level is neglected, the deadline rate will become so high that the unit mission cannot be accomplished and the increased load on the supporting maintenance units will eventually affect the mission performance of other watercraft units by depriving them of normally required support.

A system of daily and scheduled preventive maintenance inspections and services will be established and performed in accordance with applicable technical manuals. When the technical manuals are not available, or have not been published, TB 55-1900-202-12/1 provides the minimum preventive maintenance guidance. If scheduled maintenance is performed regularly and properly, the percentage of craft down because of equipment or mechanical failure should seldom exceed the 25-percent rate. When the deadline rate exceeds this figure appreciably or for abnormal periods of time, the commander should make every effort to insure that operation of the watercraft is not abusive or improper and that regular maintenance services are not being performed in a perfunctory manner.

A listing of organizational maintenance repair parts and special tools is contained in the -20P-series of technical manuals published for each craft. These manuals list allowances of repair parts that are authorized to be maintained in the unit. The levels prescribed cannot be exceeded unless proper authority is obtained. If the company commander determines through experience that certain components suffer a higher mortality rate than the stock level will support, this information must be brought to the attention of the higher command level for authority to initiate remedial action. It must be kept in mind that an excess of repair parts contributes appreciably to the weight of the unit and creates storage and accountability problems. Of greater importance, the parts thus removed from supply channels are being denied to units having an immediate need for them.

10-4. Direct Support Maintenance

Direct support maintenance is that maintenance normally authorized in direct support of using organizations and performed by designated maintenance activities. This category encompasses the repair of unserviceable assemblies on a return-to-user basis.

Direct support maintenance for harbor craft is performed by the floating craft general support maintenance company as specified in paragraph 10-5. Direct support maintenance for amphibians and landing craft is provided by the transportation lighterage company, maintenance, direct support, organized under TOE 55-158. The lighterage direct support maintenance company has the following capabilities:

- Providing 21,900 man-hours per month of direct support maintenance for amphibians and landing craft and their components in around-the-clock operations—the equivalent of from four to five amphibian or landing craft units.
- Providing 900 man-hours per month for inspection, test, adjustment, minor repair, and replacement of radio and radar equipment.
- Receiving, storing, and issuing approximately 8,000 line items of repair parts for amphibians and landing craft supported by the company and receiving, storing, and issuing organizational repair parts required by the supported units.
- Furnishing contact teams for onsite repair of disabled amphibians and landing craft and providing technical assistance to supported units.

Operational readiness floats of selected end items and components are provided to the lighterage direct support company for direct exchange to supported units for unserviceable reparable items. Operational readiness float items are issued to direct support units in the same priority as that assigned to the supported units for initial issue of the item. Unserviceable reparable items exchanged for operational readiness float items are programed for immediate repair and return

to operational readiness float. Operational readiness float items will not normally be used to replace items that have been lost or destroyed or that have been determined to be uneconomically repairable by direct support and general support maintenance activities. The lighterage direct support company is normally attached to the terminal battalion and is located in the rear of a beach complex where amphibians and landing craft are being employed in logistical beach operations. When required, contact teams are organized and sent to a unit for onsite repair of disabled craft. Detachments may be organized from the service and equipment platoon to provide direct support for lighterage units dispatched to remote areas on special missions. After the missions are completed, the detachments are returned to the parent unit. When so employed, these detachments are dependent upon the supported unit for mess and other administrative support, although they remain under the operational control of the parent unit. The ID team in TOE 55-550 may be used in this role, in addition to augmenting the capability of the direct support company. For detailed information on the organization, functions, and methods of operation of the lighterage direct support company, see FM 29-39.

10-5. General Support Maintenance

General support maintenance is that maintenance authorized in support of the Army supply and maintenance system and performed by designated TOE and table of distribution organizations. Normally, general support maintenance units repair or overhaul materiel to required maintenance standards on both a return-to-stock and a return-to-user basis according to applicable area supply requirements. General support maintenance also includes both scheduled and unscheduled drydocking of vessels.

Since they are employed in the same general operational area, all three types of Army floating craft—amphibians, landing craft, and harbor craft—are provided with general support maintenance by the same organization: the transportation floating craft general support maintenance company organized under TOE 55-157. At full strength, this unit has the following capabilities:

- Providing 27,900 man-hours per month of general support maintenance for amphibians, landing craft, and harbor craft and their components.
- Providing 1,668 man-hours per month of inspection, test, adjustment, and repair of communications and electronics equipment authorized and installed on supported floating craft.
- Receiving, storing, and issuing approximately 8,000 line items per month of marine-peculiar repair parts and related items of supply required by supported units.

The company is assigned to a field depot of the theater

army headquarters and is normally further attached to the terminal group or battalion which it supports.

Although shore-based repair facilities may be established if required, the bulk of the unit's work is accomplished aboard its 210-foot, nonpropelled floating repair shop, which contains all the shop facilities necessary to support the company mission. Three repair sections, a supply platoon, and a repair control section normally function aboard the floating repair shop.

Because of the requirement for a protected berth for the floating repair shop, the floating craft general support maintenance company normally operates in an established port terminal that is centrally located in relation to other terminals. In addition to its mission support for all floating craft located within its area of responsibility, the floating craft general support maintenance company provides direct support maintenance for all harbor craft operating in the same terminal.

Disabled floating craft from other supported terminals are normally evacuated by water to the general support unit, but emergency contact teams may be organized from the various shop sections and transported by landing craft to outlying terminals to accomplish onsite repair.

The floating craft general support maintenance company obtains replenishment of its repair parts stocks by submitting requests directly to the materiel management center, which directs shipment from the field depot that stocks the requested items. Items repaired by the general support company are disposed of as follows:

- Returned to the using unit through the appropriate direct support organization.
- Returned to general support supply stocks within the company or to the appropriate field depot that stocks marine items.

10-6. Depot Maintenance

Depot level maintenance includes rebuild of major components, modification of materiel beyond the capability of lower levels of maintenance, and repair of end items on a return-to-stock and subsequent reissue basis.

Since no Army TOE units exist to perform depot maintenance of floating equipment, this support is obtained from other sources. In the continental US, depot maintenance is accomplished through contract by commercial facilities. In oversea areas, this support may be provided by commercial contract or interservice support agreements with the US Navy. In accordance with AR 750-1, guidance for obtaining depot maintenance support (and funding) will be provided by the appropriate national maintenance point or national inventory control point.

10-7. Maintenance Management

Watercraft maintenance management is the responsibility of terminal group and battalion commanders to which the unit's operating craft are attached and includes the following:

- Establishing the requirements for time, trained personnel, tools, test equipment, facilities, funds, and repair parts and other maintenance supplies that are essential in accomplishing the maintenance mission.
- Planning, programing, and budgeting for proper use of maintenance resources.
- Providing technical supervision and management control over maintenance programs and activities.

- Reviewing accomplishments in relation to effective and economical utilizations of maintenance resources.
- Evaluating maintenance concepts, policies, doctrine, plans, and procedures to insure that they contribute to accomplishment of the overall military mission.
- Recommending new maintenance concepts, policies, doctrine, plans, and procedures for the Army maintenance system.
- Coordinating with the maintenance element of the appropriate materiel management center and providing it with information on maintenance programs, status, requirements, and performance.

CHAPTER 11

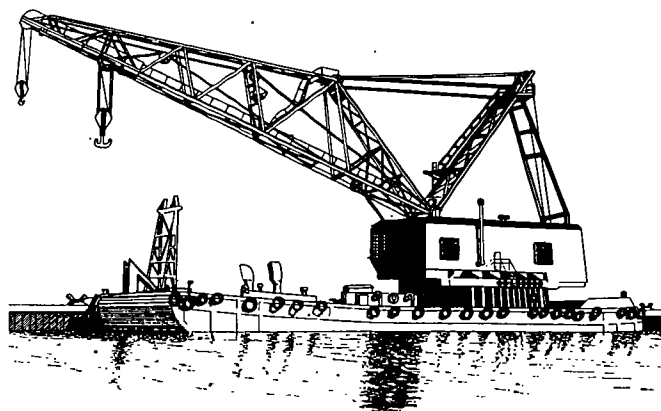
MARINE CASUALTY REPORTING

11-1. Initial Report of Marine Casualty

If an Army vessel is involved in a marine casualty, the master is required to report the casualty as soon as possible. This initial report is in addition to a later detailed report. An initial report is required in the event of death or serious bodily injury to a person, serious damage to a vessel or other property, damage which threatens substantial delay to a vessel, or salvage service rendered to or by an Army vessel. In the event of death or disability of the master, the senior surviving officer or crew member makes the initial report. If the vessel is unmanned, the report must be made by the commander having custody of the vessel or knowledge of the event. It can be given in person or by telephone, telegraph, cable, radio, teletype, or any other means that the master or other person reporting feels is appropriate under the circumstances.

When a marine casualty occurs at or in the vicinity of the home port of the vessel, the initial report is made to the port commander or to an officer or civilian employee designated by the commander to receive such information. If the casualty occurs at sea or some other place away from the home port, the report is made according to the instructions of the commander of the home port and of the installation under whose immediate control the vessel is operating. If instructions have not been received and the vessel is under control of an installation other than the home port, the report is made to the commander of the Army port or installation under whose immediate control the vessel is operating, who in turn immediately notifies the commander of the home port. If instructions have not been received and the vessel is not under the control of an installation other than the home port, the report is made to the home port commander, either directly or through the nearest available Department of Defense facility.

The initial report contains the name and official number of each vessel involved, the nature of the occurrence, and the location of the vessel. It gives the names and addresses of all those who died or those who were injured because of the casualty. The report also covers the extent of damage or loss to each vessel and its cargo, whether the Army vessel is able to proceed on its voyage, and the ownership of cargo involved. It shows whether salvage services are being received or rendered by the Army vessel and, if so,



the official number and ownership of the other vessel and, if it is the Army vessel that is being salvaged, whether the salvage is being rendered under contract. The report also shows whether the damage can be repaired at sea or at the port at which the vessel may be located and the probable date when repairs can be completed. These requirements are detailed in AR 55-19.

11-2. Written Report of Marine Casualty

When an Army vessel is involved in a marine casualty, its master or senior surviving officer or crew member or, if unmanned, the person in charge makes a written report of the incident within 30 days. This is known as the report of marine casualty and follows the initial report. The information that must be included in the written report is prescribed in AR 55-19. There is no standard DA printed form for submitting the information; however, a local form may be printed.

An original and seven copies of the report must be made. One copy is filed with the vessel's papers. If the casualty occurs at the vessel's home port, the original and six copies are sent to the commander of the port or to a person he designates to receive the report. If the incident occurs while the vessel is operating under the control of another port or installation commander, the original and six copies are forwarded to that commander. If the vessel is operating in overseas waters and there is no Army port or installation convenient, the original and six copies are forwarded to the nearest diplomatic or consular office with a request that all copies be forwarded to the commander of the vessel's home port.

When a marine casualty resulting from enemy or combat action occurs in convoy, under naval escort, or during combat or landing operations, a report of marine casualty is not required. If a marine casualty involves an unescorted vessel, the initial report and the report of marine casualty are required even though the casualty is caused by enemy or combat action. A marine casualty investigation and a report of marine casualty are not required when landing craft and amphibians are damaged while beaching during

training exercises or during normal ship-to-shore operations where damage can be expected because of peculiarities of the operation, where no property other than Government property has been damaged or destroyed, where no death or serious bodily injury to personnel is involved, and where first notice discloses that damage is not due to negligence nor incompetence of personnel.

11-3. Accident Report

Whenever a marine casualty occurs during loading or unloading of a vessel—whether being done by DA personnel (military or civilian) or contract stevedores—and results in bodily injury or damage to a vessel, cargo, or Army property, a report of accident must be made immediately on DA Form 285 (accident report). This report is prepared in accordance with AR 385-40 and is submitted in addition to those required by AR 55-19. The military or civilian supervisor directly in charge of the work completes the report and forwards it to the commander of the installation or to someone designated by the commander to receive such reports.

Whenever a vessel or other floating equipment damages waterfront property owned or controlled by the Army, the property accountable officer of the pier, wharf, or other waterfront facility reports the damage on DA Form 285.

11-4. Preserving Evidence

All logbooks, such as rough and smooth deck and engineroom logs, aboard an Army vessel when a serious marine casualty occurs are to be carefully preserved aboard the vessel until the marine casualty investigating officer gives instructions for their disposition. Both the master in charge at the time of the casualty and his successors are required to preserve the logbooks. If it is necessary to retire a logbook before disposal instructions are received from the investigating officer, the master informs the person responsible for receiving the logbook of its status. This person then requests instructions from the investigating officer and retains the logbook until disposal instructions are received.

If it appears that breakdown or failure of machinery or equipment contributed to a serious marine casualty involving an Army vessel, the malfunctioning and broken parts must be carefully marked for identification and preserved aboard the vessel until the marine casualty investigating officer gives instructions for their disposition.

When the breakdown or failure of machinery or equipment used in cargo handling appears to have caused or contributed to a serious accident in loading or discharging a vessel, all malfunctioning and broken parts must be preserved by the unit commander or the

civilian supervisor until he receives disposal instructions from the marine casualty investigating officer. If the physical evidence is private property or that of another Government agency, the commander or supervisor must ask the owner to give him the property or to preserve it for him.

When a civilian employee of the Government or of a Government contractor is injured, all of that person's current records such as timesheets, timeslips, and worksheets will be held pending instructions from the investigating officer.

11-5. The Investigating Officer

The commander of each oversea command, terminal, or other installation under whose immediate control an Army vessel operates, designates, in orders, a commissioned officer, a warrant officer, or a qualified civilian of his command as the marine casualty investigating officer of the command. The person appointed must be an officer or warrant officer of the Judge Advocate General's Corps or a civilian experienced in conducting investigations, trained in maritime law, and familiar with vessel operating standards and practices. When such personnel are unavailable within the command, an officer, warrant officer, or civilian experienced in the marine field may be appointed to carry out the duties of investigating officer until a qualified person can be obtained. A civilian or warrant officer may not serve as an investigating officer or board member when the pertinent law or regulation requires that the investigating officer or board member be a commissioned officer.

The investigating officer investigates any marine casualty involving damage to property, loss or destruction of property, or bodily injury or death. The officer's investigation covers all phases of the casualty and its future bearing on the interests of the service, including possible claims against the Government or in favor of it; the line-of-duty status of military personnel; survey matters; the necessity for special reports of fires, explosions, storms, and other serious occurrences; and the question of whether the circumstances call for disciplinary action under Article 139 of the Uniform Code of Military Justice.

11-6. When an Investigation Is Required

Immediate responsibility for investigating a marine casualty belongs to the commander of the port or other installation in whose jurisdiction or vicinity the casualty occurred or to the commander of the first Army port of arrival of the vessel or its survivors. The investigating officer investigates the casualty whenever any of the following circumstances exist:

- Government property has been lost, damaged, or destroyed in an amount in excess of \$500, or circumstances indicate the existence of a claim in favor of the Government.

- Property other than that owned by the Government has been lost, damaged, or destroyed.
- The casualty involves death or bodily injury causing disability for duty of more than 3 days.
- Salvage service of a substantial nature has been given to an Army vessel or by the Army to any vessel.
- A claim has been made under the Army Maritime Claims Settlement Act, notice of intention to make such a claim has been given, or a claim under the act is indicated.
- An investigation is in the interest of the Government.

11-7. Scope of Investigation

In planning his investigation, the investigating officer reviews the purpose of the investigation and the use to be made of his report. He makes certain that his investigation covers all pertinent aspects of the casualty and that its scope is in accord with the nature and extent of the casualty. The following guidelines should assist an officer in determining the scope of an investigation:

- When the casualty involves Government personnel or property only, the possibility of a claim may generally be disregarded.
- When a general agency agreement vessel, a privately operated Navy tanker, or any other Government vessel covered by protection and indemnity liabilities insurance damages Government property, the investigation should be extensive enough to develop a claim against the operator.
- Whenever Government property is destroyed or damaged through the willful misconduct or gross negligence of Government personnel, sufficient information should be developed to determine whether claims action should be taken against the personnel.

11-8. Action of Investigating Officer

In investigating the casualty and preparing a report, the investigating officer takes as many of the actions listed below as are pertinent and appropriate under the circumstances:

- Issues instructions on preserving evidence; that is,

retaining or disposing of broken parts of equipment or machinery that may have caused the casualty or contributed to it. If they are to be retained, he arranges to have them marked and stored. He also arranges for storage and safekeeping of all logbooks, records, timesheets, etc., necessary or desirable to have preserved for claims or litigations. He makes a note of this action in his report and keeps an additional record in the office of the staff judge advocate.

- Arranges a prompt survey of any damage sustained and of machinery, parts, etc., that may have caused the casualty or contributed to it by breakdown or failure to operate properly. When competent Government personnel are not available to make the survey, commercial marine surveyors may be employed.

- Secures a signed statement, preferably sworn, from each person with knowledge of pertinent facts and circumstances. Getting such statements promptly is of the utmost importance in obtaining the accurate, uncolored evidence necessary for proper action on any claim. Statements of witnesses whose testimony is merely cumulative or corroborative and not likely to be adverse to the interest of the Government are not required.

- Prepares a list giving names and addresses of all witnesses; the list is to be included in the report of marine casualty and the report of claims officer.

- Reviews the report of marine casualty or accident report; considers all the information and evidence obtained from any previous inquiry or investigation of any aspect of the casualty.

- Coordinates with any other DOD agency involved in the casualty, obtains copies of surveys and reports which that agency makes, and avoids any unnecessary duplicate investigation.

- Conducts fairly and impartially any further investigation required to develop pertinent facts and information.

- Makes every effort to clear up disputed matters and to determine the facts of all pertinent issues.

- Prepares his report on DA Form 1208, Report of Claims Officer.



CHAPTER 12

BEACH AND WEATHER CHARACTERISTICS

12-1. General

The ideal beach for landing craft and amphibian operations is one with no underwater obstructions to seaward, deep water close to shore, a firm bottom of hard-packed sand and gravel, minimum variation in tides, no current or surf, and a moderate to gentle (1:15 to 1:60) underwater beach gradient. Although such a beach will rarely exist in the area of operations, the battalion or unit commander weighs the characteristics of existing beaches against these desirable features.

12-2. Beach Composition

Beaches are classified by their predominant surface material, such as silt, mud, sand, gravel, boulders, rock, or coral or by such combinations as sand and boulders. The ideal composition for beaching of landing craft and amphibians is a combination of sand and gravel. Silt, mud, or fine sand may clog the cooling systems of landing craft. Rock, coral, or boulders may cause damage to the hull or to the underwater propulsion and steering mechanism.

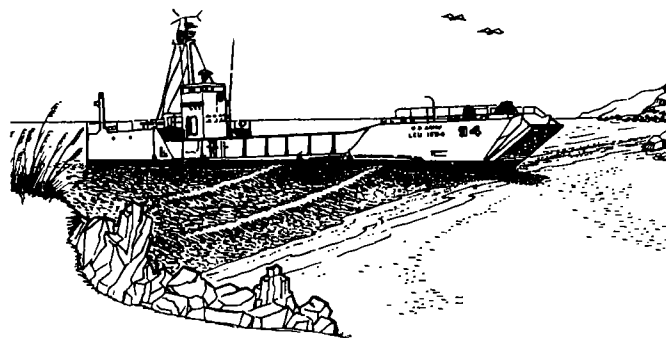
Firm sand will provide good beach trafficability for personnel and vehicles. A beach is usually firmest when it is damp and when the material is of small size. Gravel has good bearing capacity but poor shear strength. As a general rule, the coarser the material the poorer the trafficability.

12-3. Beach Gradient

The underwater slope or gradient of a beach is usually expressed as a ratio of depth to horizontal distance. For example, a gradient of 1:50 indicates an increase in depth of 1 foot (.3048 meter) in every 50 feet (15.2 meters) of horizontal distance. For landing operations, it is usually necessary to find the gradient only from the water's edge seaward to a depth of 3 fathoms (5.5 meters). The following scale is usually used to describe beach gradients:

Steep	More than 1:15
Moderate	1:15 to 1:30
Gentle	1:30 to 1:60
Mild	1:60 to 1:120
Flat	Less than 1:120

Underwater gradients can seldom be determined from hydrographic charts. There are only a few areas for which charts scaled larger than 1:100,000 exist.



Moreover, since the inshore seabed is subject to frequent change, only a very recent survey would have any value. However, there are ways of estimating gradient.

An examination of terrain and hydrographic features will provide some indication of the nature of the underwater gradient. If the land area behind the beach is flat and is sandy or marshy, it is reasonable to assume that the sea bottom close inshore will also be fairly flat. A high, well-defined beach crest indicates a coarse material; generally, the coarser the beach material on an exposed beach, the steeper the gradient. Wide beaches are usually firm and flat with a slight gradient; narrow beaches, steeper and somewhat softer. The position and character of the surf zone will often indicate gradient. If the surf is breaking almost on the shoreline and the surf band is narrow, the gradient will be steeper than when breakers are well offshore and the surf band is wide. Gradient may also be approximated by aerial photography. High water and low water sorties are best for this purpose. The range and interval of the tide and the horizontal distance of rise or fall will provide sufficient data for determining the gradient of the high-water-to-low-water zone. An irregular, rugged coast usually develops intermittent steep beaches, rock outcrops, and reef; ledges may be expected offshore.

If the underwater gradient is mild or flat, a landing vessel will ground by the stern at a considerable distance offshore, leaving the bow afloat. On the other hand, if the gradient is too steep, only the forward part of the bow section of the boat comes into contact with the beach and the vessel may tend to pivot or broach to whenever there is a current along the beach, the surf is heavy, or strong crosswinds arise. A gradient slightly steeper than 1:50 is considered suitable for a loaded landing ship, tank (LST); a 1:20 gradient is desirable for a landing craft, mechanized (LCM).

12-4. Sea Bottom

Coarse sand, shell, and gravel bottoms and similar foreshore beach compositions most nearly approach the ideal for landing craft and amphibian operations. They are firm and usually smooth although bank, bar, and shoal formations are common. Bottom compositions of soft mud or fine loose sand can be hazardous to

boats, vehicles, and personnel. Boats may be put out of action because of fouled engine cooling systems. To prevent this situation, crews on craft equipped with beaching tanks should rely on this supply of cooling water during beaching operations. Crews on vessels not equipped with beaching tanks must clean the sea strainers frequently to insure an adequate supply of cooling water to the engine. LVT (landing vehicles, tracked) and other tracked vehicles sink into beaches having a soft bottom and lose traction. Wheeled vehicles may dig into sand or mud and become immobilized. Personnel find walking difficult.

Mud and sand bottoms may be either firm or soft, depending on the percentage of sand. A mud bottom over a rock base may be satisfactory if the mud is not more than 1 or 2 feet (.3 or .6 meter) deep. Coral heads, rocks, and other underwater obstructions in the shallows near shore can cause bent propellers and shafts, broken skegs, and punctured hulls. Rocks that are covered with algae are extremely difficult for personnel to walk on and may cause wheeled vehicles to lose traction.

12-5. Sandbars

Sandbars are likely to develop offshore of sandy beaches exposed to wave action, and bars are often located off long, continuous beaches of any type. On aerial photographs of quiet sea and clear water, a sandbar appears as a narrow band of light tone against the dark bottom. On photographs of rough water, a sandbar can be detected by a line of breakers outside the normal surf zone.

A sandbar indicates a sandy bottom offshore and, unless there are visible rock outcrops, probably a smooth, sandy bottom inshore of the bar. These characteristics, when accompanied by sand dunes behind the beach, indicate that the beach is primarily sand. Surf is likely on such beaches; the height of the surf can usually be estimated accurately under a given wind or sea swell condition if the approximate depth over the sandbar is known.

Sandbars can be a serious menace to landings. Craft may run hard aground on them while still some distance from the beach loading or discharge point. When this occurs and an appreciable sea is breaking on the bar, there is danger of the craft's swamping and broaching to. If troops debark while the craft is hung on a sandbar, they may be endangered owing to depth of water, strong currents, or a soft bottom between the bar and the beach. Rather than chance this occurring, it is better to remain aboard the craft as successive seas may lift the craft over the bar and it can then proceed to the beach.

If the sea condition permits and it appears unlikely that the craft can free itself from the bar, personnel should be transferred to wheeled amphibians and salvage commenced to retrieve the craft. Depths of

water on the bar and between it and the beach at various stages of the tide influence the times at which beachings can be attempted.

Even though there are no bars on a beach at the initial landing, they may be created by the scouring action of the propellers of beached landing craft. After several days, a built-up bar of this type may be large enough to prevent the satisfactory beaching of LST and similar vessels. Alternating beaching sites will reduce this hazard.

Small sandbars may be formed between runnels within the tidal range on foreshores having a slight slope. The height of these bars is seldom more than 2 feet (.6 meter) from the bottom of the trough to the top of the crest. However, such bars pose hazards to operation in that landing craft may ground on the crests and troops and equipment must cross the stream of water to reach the dry shore. If the bottom of the runnel is silt, vehicles and heavy equipment may bog down. It may be necessary to beach the craft near the time of high tide and unload it after the water has receded to a point where matting can be laid across the troughs.

12-6. Rocks

Rocks on a beach may limit the inshore approaches so that only a few craft can land at a time. This will prevent a large-scale landing and will restrict beach operations. However, one or two rocky patches fronting a beach do not present a serious obstacle as there is slight chance that craft will strike them if their locations are properly marked with buoys.

In aerial photographs showing a heavy sea, rocky patches on the bottom can usually be detected because waves break over them. A light sea with waves breaking on the rocks indicates that the rocks are dangerously close to the surface.

12-7. Reefs

Coral reefs are found in shallow salt water in tropical areas. There are three general types: fringing, barrier, and atoll.

Fringing reefs are attached to the land. The width of the reef is seldom more than a mile and may be only a few feet. Inshore boat channels are often present on fringing reefs but do not occur when the reef is narrow and exposed to heavy surf action. These boat channels are about 1 to 5 feet (.3 to 1.5 meters) deeper than the rest of the reef surface and may be from 10 to 50 yards (9.1 to 45.7 meters) wide. These channels run close to the shore and parallel to it, and open seaward through breaks in the reef. They may be continuous for a nautical mile (1.852 kilometers) or more. The channels act as traps for sediment brought down from the land or shifted inshore from the seaward side of the reef. This sediment is often quite fine, giving the boat channels a bottom of sand or mud, although there may be

clumps of live coral in them. Generally, they are deep enough for the smaller landing craft and too deep for troops to wade.

Barrier reefs lie offshore and are separated from the land by a body of water called a lagoon. There may be a fringing reef on the land side of the barrier reef. Barrier reefs vary in width from a few hundred feet (meters) to more than a nautical mile (1.852 kilometers) and may have reef islands on them.

Atoll reefs are barrier reefs that enclose lagoons. They usually have a crescent shape with the convex side toward the sea. They may contain reef islands, or heads, composed of accumulated debris from the reef. These circular, drumlike islands are seldom more than 10 to 15 feet (3.1 to 4.0 meters) higher than the reef flat. They may be up to 100 feet (30.5 meters) in diameter, and the interior may be low and swampy. The water surrounding a coral island is usually smooth, and presence of the island may not be indicated by surf. However, the water changes near the island from a deep blue to a light brown. The chief obstacles on the seaward side of an atoll reef are the marginal ridge with its consequent surf and the scattered boulders on the reef, which are difficult to spot. The inshore part of the reef is usually critical in landing operations. Often it is a band from 50 to 100 yards wide (45.7 to 91.4 meters) with boulders that may impede the progress of vehicles. On the whole, the surface of an atoll reef is more favorable for crossing than the surface of a fringing or barrier reef. On the lagoon side, the beaches are apt to be composed of softer sand than the seaward beaches. A landing on the lagoon side should be undertaken at high tide, and the numerous coral columns that grow in shallow water near the shore must be bypassed.

12-8. Seaweed

Seaweed is usually found in calm waters. It may interfere with the operation of landing craft and wheeled or tracked amphibians. The marine growth may consist of free floating minute particles that clog sea strainer intakes for engine cooling water, or it may be a thick, heavy type of weed that fouls propellers and tracks.

12-9. Currents

When visibility is poor, water currents of variable direction of flow and changing velocity may interfere with or prevent landing at the designated point on a beach. Where alongshore currents are anticipated, there must be unmistakable markers or landmarks to identify the beach and the approach lanes to it. Even though compasses on landing craft may be properly compensated, current and weather may prevent boat operators from making good the intended course. To overcome this possibility, all boat operators must be aware of natural and artificial ranges that can be used to mark beach approaches during day and night opera-

tions. Directing individual craft by radio from a radar-equipped command and control boat or from the vessel being discharged has proven a satisfactory method during periods of reduced visibility.

A strong alongshore current may be a contributing factor to broaching to of craft. A broached-to condition exists when a craft is cast parallel to the current or surf and grounded in a manner that greatly reduces maneuverability. Extreme care must be exercised by boat operators to prevent this from occurring when approaching, retracting from, or attempting to maintain position on a beach. Broaching to is dangerous if a surf is running since the craft can be swamped or driven higher onto the beach; in either case, assistance will probably be needed to recover the boat. Unloading broached-to craft is difficult. Injury to personnel and damage to the craft and its cargo may result from attempts to remove cargo when the craft is not perpendicular to the surf or current. If there are very strong alongshore currents, the beach may become cluttered with broached-to and swamped boats unless broaching lines are used or breakwaters and jetties are constructed.

Rip currents flow out from the shore through the breaker line in narrow bands or rips and are formed on almost all open coasts. They consist of three parts: the feeder currents, which flow parallel to shore inside breakers; the neck, where the feeder currents converge and flow through the breakers in a rip; and the head, where the current widens and slackens outside the breaker line. Troughs cut into the sand by rip currents having a velocity of more than 2 knots (3.7 kilometers per hour) may form hazards for landing craft. On an aerial photograph, a rip current appears as a narrow band of agitated water, usually marked by breakers:

12-10. Surf

The height of surf can be a critical feature in a landing, possibly disrupting boat formations and damaging craft. Although hazards to boats increase with increasing breaker height, difficulties encountered also depend on the width of the surf zone, the time between breakers, and the type of breaker. If there is a narrow zone with high surf, the operator may lose control of his craft and it may strike the beach before he can regain control. Broaching to and swamping may result. Swamping frequently occurs when a powerful wave strikes a broached-to craft. The action of surf on swamped boats may fill them with sand and may impede salvage operations. If there is a narrow, violent surf, it may be possible to land troops, but the initial loss of craft may prevent landing more personnel and cargo. With a wide surf zone, the uprush on the beach is gentle and the risk of broaching to is greatly reduced.

Swamping is rarely caused by surf conditions alone: in

many cases it results from improper boat handling. An experienced operator can bring his craft safely through high breakers, but great skill is required, because the breakers travel faster than the craft. The speed of a 10-foot (3.048 meters) wave is 12 knots (22.2 kilometers per hour); an LCM-8 when fully loaded has a speed of 10 knots (18.52 kilometers per hour). A craft overtaken by a plunging breaker may get out of control and broach to or collide with another craft. Danger of the craft's swamping in heavy surf is greater during retraction, particularly if the craft gets in a position that causes it to ship water from several successive breakers.

12-11. Tide

Tide is the periodic rise and fall of water caused primarily by the gravitational effect of the moon and the sun upon the rotating earth. In addition to the rise and fall in a vertical plane, there is a horizontal movement resulting from the same cause. This is termed the tidal current. When the tidal current flows shoreward, it is known as flood tide; when it flows seaward, it is called ebb tide.

High tide, or high water, is the maximum height reached by the rising tide. Low tide, or low water, is the minimum height reached by the falling tide. The difference between the level of water at high and low tides is the range of tide.

The period of tide is the interval of time from one low tide to the following low tide or from one high tide to the next high tide. These intervals average 12 hours and 25 minutes at most places. About every 2 weeks—when the moon is new and when it is full—the highest high water and the lowest low water occur, making an unusually large range of tide. This is because the attractive influence of the sun and moon upon the water are combined and working together at these times. These tides are known as spring tides. When the moon is in its first quarter and when it is in its third quarter, the attractive influences of the sun and the moon are opposing each other and the range of tide is unusually small. Tides during these times are known as neap tides. Tides occurring when the moon is at its maximum semimonthly declination are tropic tides. At this time there is an increase in the daily range. Tidal range also varies with coastal configurations and barometric pressure.

The stage of the tide affects the width of the beach and, accordingly, the type of surf, the depth of water over sandbars and reefs, the width of exposed beach that must be traversed, and the requirements for special equipment to facilitate debarkation. Extreme tidal ranges may restrict unloading to the period of high tide, requiring maximum speed of operation and a rapid and heavy buildup of supplies in the early stages of a landing.

If there is a relatively large tidal range on a gently

sloping beach, water may rise or descend on the beach so rapidly that craft will be stranded on a dry bottom before they can retract. This may put a critical number of craft out of action until the next rise of tide. If, in addition to a flat gradient, the bottom has many irregularities, a fall in the tide may ground craft far from the beach proper. Personnel will have to debark and wade through pools of water left on the beach, and equipment will have to be driven ashore through these pools. If they are deep, a considerable loss of equipment can be anticipated.

In some cases the effect of the tide may require that craft be held at the beach as the tide recedes, discharging their cargo while resting high and dry on the exposed beach. They then retract on the following tide.

The force of an unusually strong wind exerted on the tide at the landing area may greatly alter the width of beach available for operations. In conjunction with an ebbing tide, a strong offshore wind may blow all the water off the beach and on a gentle gradient the water level may recede to an extreme distance from the beach proper. Personnel and materiel must then pass over a wide exposed beach. On the other hand, a powerful onshore wind can increase the advance of high tide to such an extent that beach installations and activities are endangered or flooded.

Where obstacles do not exist, it is generally preferable to make a landing on a flood tide so that craft may be beached and retracted readily. Normally it is desirable to set the time for landing about 2 or 3 hours before high tide.

12-12. Wind

Wind velocity, the distance spanned by the wind, the duration of the wind, and decay distance influence swell and surf conditions on the beach. Winds at or near the surface of the earth have been classified, and their characteristics are known and predictable. Some surface winds are very deep and may extend for miles into the air; some are shallow, such as the land breeze, which is apt to extend only a few hundred feet (meters) above the surface. Winds aloft may blow in a direction opposite to surface winds, and velocity and direction may vary with different elevations.

The growth of waves in a generating area is governed by the velocity and duration of the wind and the extent of the water area over which the wind has acted in producing waves. Swells are waves that have progressed beyond the area of influence of the generating winds.

A very rough sea will disrupt landing schedules and formations by restricting the speed and maneuverability of craft. Normal problems of control and coordination become more complex. Planners must consider the effects of heavy seas on landing craft when establishing timetables, distances to be traveled on the

water, and loads to be carried. With an excessive or poorly distributed load, boats may list severely or even sink. Extremely rough conditions may make it necessary to remove loads from the craft and place the craft aboard vessels or in a safe haven.

When a rough sea is anticipated, craft carry smaller loads and proceed cautiously and ship-to-shore distances are reduced as much as feasible. Since the unloading of equipment and supplies may be restricted by heavy seas, priorities must be established among critical items so that the most essential shore requirements are met as quickly as possible.

12-13. Weather Information

Weather information concerning the area of operations must be analyzed carefully to determine the probable effect of weather upon craft operations and working conditions. Early in the planning stage, the battalion commander must find out from what source and in what manner weather information will be furnished.

The success of a tactical operation may depend upon a sequence of several favorable days after the initial landing has been made. The most important consideration is the sea and swell caused by high winds and storms. Excessive sea and swell may end the movement of later serials, thus placing the assault troops in a precarious position ashore. Planners must consider beaching conditions, unloading conditions, speed of vessels, the effect of wind and sea on the tides, and the physical condition of troops.

Alternate plans for a waterborne movement must take into consideration possible variations from average weather. Weather conditions en route to the area must also be considered. In a tactical operation, maximum advantage must be taken of weather conditions that might conceal an approach to the objective area.

If the approach is made in calm, clear weather, the enemy can locate the attack force more easily, his air attacks will not be impeded, and he can determine the location at which the landing is to be made. Bad weather, storms, fog, and winds affect the movement, but they also force the enemy to rely upon more indirect and less dependable means of attack and of determining the target area.

Weather information must receive priority in communications so that plans may be made or altered without delay, especially if unusual weather conditions are anticipated. In estimating the effects of weather upon an operation, planners consider these factors:

- Winds—the direction and speed of winds at the surface and in the upper air, the likelihood of storms, and the nature of storms that are typical in the target area.
- Visibility—the distance at which objects can be seen

in a horizontal direction at the surface and in both a horizontal and vertical direction in the upper air; the restrictions imposed on visibility by fog, haze, rain, sleet, or snow.

- Temperature—the effect of extremes of temperature on personnel and materiel.
- Precipitation—the effect of excessive rain or snow on personnel and materiel.

12-14. Weather Forecasts

Weather prediction is based on an understanding of weather processes and observations of present conditions. Weather forecasts are essentially a form of extrapolation in which past changes and present trends are used to predict future events. In areas where certain sequences follow with great regularity, the probability of an accurate forecast is very high. In transitional areas or areas where an inadequate number of reports is available, the forecasts are less reliable; such forecasts are based on principles of probability, and high reliability should not be expected. A forecast for 6 hours after a synoptic chart (weather map) is drawn should be more reliable than one for 24 hours ahead. Long-term forecasts for 2 weeks or a month in advance are limited to general statements. For example, a prediction is made as to which areas will have temperatures above or below normal and how precipitation will compare with normal, but no attempt is made to state that rainfall will occur at a certain time and place.

Synoptic forecasts are used primarily for day-to-day forecasts. They are developed from reports received from a widespread network of stations that make simultaneous observations at prescribed times. Data resulting from these observations are transmitted to a weather center and analyzed, and the forecast resulting from this analysis is forwarded to the operating units concerned. This type of forecast requires that the system of communication be dependable and that observers be located over a wide area, possibly including territory in possession of the enemy. Synoptic forecasts suitable for landing operations can be made only 1 to 2 days before the operation, but such forecasts will generally be dependable.

Conditions beyond the range of synoptic forecasts are estimated by the statistical method. This method relies upon weather observations accumulated over a period of years and describes the average type of weather that may be expected in a given area. It shows such information as the strength and direction of prevailing winds, average temperatures, and average precipitation. If weather records at a given area have been kept for a number of years, it is possible that the statistical study will be correct about 65 percent of the time.

The value of a forecast is increased if one has access to the information upon which it is based and under-

stands the principles and processes involved. The factors that determine weather are numerous and varied. Increasing knowledge regarding them makes possible a continually improving weather service. However, the ability to forecast is acquired through study and long practice, and the services of a trained

meteorologist should be used whenever possible. Data about average weather conditions are essential in planning a landing operation, but information required for an assault landing should be current. A forecast 24 to 36 hours old cannot be relied upon.

CHAPTER 13

FUTURE TRANS-HYDRO DEVELOPMENTS

13-1. General

AR 10-5 states that the organization of the Army". . . includes land combat and service forces and such aviation and water transport as may be organic therein . . ."

This chapter is intended to describe the actions recently taken and currently underway to improve the Army's ability to accomplish that portion of its service support mission which requires the use of organic watercraft.

13-2. Background

Several years ago it was recognized that the majority of the vessels in the Army's watercraft fleet have to be replaced soon. This is due to—

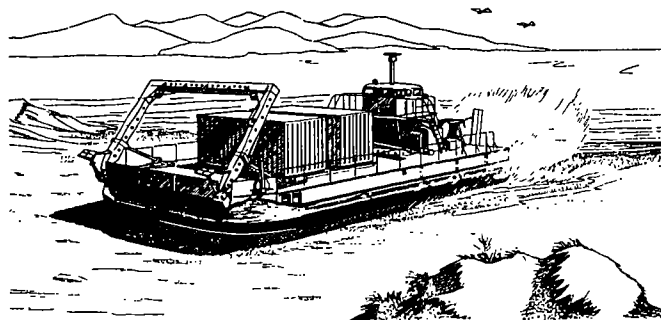
- Advanced age.
- Hodgepodge of design variations which makes maintenance very difficult and expensive.
- Lack of an acceptable capability to transport MILVAN's or SEAVAN's, which represent the largest single group of nonmobile heavy lifts to be transported by Army watercraft.

In order to determine the type of craft that can best and most economically perform the Army's watercraft mission during the future years, a comprehensive study was made. This study was published in December 1973 under the title, *US Army Trans-Hydro Craft Study, 1975-1985 (Trans-Hydro)*.

The Department of the Army designated the US Army Combat Developments Command (USACDC) as the organization responsible for accomplishing the study. USACDC headquarters tasked its Transportation Agency (now Directorate of Combat Developments, US Army Transportation School) to conduct the study. To insure that the study results represented a comprehensive collection of information, basic input was obtained from a number of different agencies, to include—

- US Navy
- US Maritime Commission
- US Army Materiel Command
- Military Traffic Management Command
- USACDC Supply Agency
- USACDC Systems Analysis Group

Overall guidance was provided by a Department of the Army study advisory group.



13-3. Definitions, Trans-Hydro

To assist in reaching a common understanding of the term "trans-hydro craft," as well as several other terms and acronyms used in the study and referred to in this chapter, the following definitions are provided:

Air cushion vehicle (ACV)—a vehicle that hovers or moves just above the surface by varying the direction and volume of a cushion of supporting air in conjunction with conventional propeller or jet thrust.

CHI—an acronym used to describe coastwise distribution, harbor service, and inland waterway service performed by Army craft.

Hydrofoil—The hydrofoil considered in the study is essentially a foreshortened planing craft with submerged, tandem, nonretractable foils.

Trans-hydro craft—craft that float on the surface of the water; are supported above the surface of the water by an air cushion, foil, or other means; or fly over a body of water (they may also possess land mobility).

13-4. Trans-Hydro Craft Requirements

The initial phase of the study included the identification of the combat service support missions that will require the use of trans-hydro craft during the 1975-85 time frame. These missions, as approved by the Department of the Army, are as follows:

- Operate trans-hydro craft in order to provide for the cross-water movement of cargo and passengers through water terminals. Adjacent beaches and shorelines may form a part of the total terminal complex.
- Operate trans-hydro craft in order to provide for the over-water movement of cargo and passengers in logistics over-the-shore (LOTS) operations (these trans-hydro craft may possess land mobility to permit uninterrupted movement to inland delivery or transfer points).
- Operate trans-hydro craft in harbors and in inland and coastal waterways in order to provide for the over-water movement of cargo and personnel in port clearance and line haul operations as the military situation requires.
- Operate trans-hydro craft in providing over-water movement of cargo and passengers within floating

logistic bases and between these bases and the tactical area of operations.

- Operate trans-hydro craft in the performance of harbor service functions in support of water terminals and LOTS operations.

- Operate trans-hydro craft in support of forces conducting amphibious operations and shore-to-shore operations.

- Provide for the movement of waterborne cargo and passengers and operate trans-hydro craft in other water transport service as directed.

The missions described above were grouped into four major types of operations, which were further identified as either LOTS or CHI missions—

Ship-to-shore	-----	LOTS
Coastal operations	} -----	CHI
Harbor service		
Inland waterway		

13-5. Classification of Existing Craft

The next study phase included the identification and classification of trans-hydro craft that are currently in the fleet. In addition to an analysis of their ability to perform the service support missions listed in the previous paragraph, craft were classified by type and evaluated on the basis of their—

- Performance characteristics

- Cost

- Capacities (in the case of LOTS craft, the study particularly tried to identify their ability to transport containers as well as noncontainerized cargo).

It was determined that there are currently 9 designs of LOTS craft¹ and 71 design variations of CHI craft in the Army inventory. The study did not consider those categories of equipment that perform specialized and/or limited service (floating cranes, dredges, lifeboats, floating repair shops, etc.).

Based on the design life for each class of craft, the study, as illustrated in table 13-1, identified *more*

than 70 percent of the current fleet as already obsolete. By 1985 this percentage will increase to 99 percent.

13-6. Selection Factors Considered

In order to select the best type of trans-hydro craft or combination of craft to meet future needs, a number of directly related elements had to be considered. These included—

- Anticipated force size.

- Resupply tonnage required to support the force, less tonnage to be airlifted into the theater.

- Percent of surface tonnage that will enter the theater through LOTS-type operations.

- Percent of surface tonnage that will enter the theater through fixed ports.

- Composition of the Military Sealift Command and maritime fleet during the 1975-85 period.

- Projection of the movement of containerized cargo through 1985.

13-7. Principal Trans-Hydro Study Recommendations

The study recommended that the Department of the Army and the United States Army Materiel Command (USAMC) take positive action to replace the current obsolete craft with the trans-hydro craft which are listed and discussed in paragraphs 13-8 and 13-9. USAMC Headquarter's 5-year plan for the procurement of floating craft indicated that all design and procurement decisions for the period beyond 1975 would be based on the Trans-Hydro study.

The study also recommended that planners and procurement personnel minimize research and development expenses by procuring commercial "off-the-shelf" craft whenever possible.

The study also recommended that emphasis be placed on worldwide standardization of the craft, to include major components and communications, navigation, and electronics equipment.

Table 13-1. Percentage of US Army Watercraft Exceeding Useful Life by 1975 and 1985

	Percent obsolete	
	1975	1985
Amphibians:		
LARC-V, XV, LX (useful life 12 years) -----	27%	100%
Harbor craft:		
Tugs, barges, FS, Y, T, Q, J (useful life 12-20 years) -----	98%	99%
Landing craft:		
LCM-8, LCU, BDL (useful life 12-25 years) -----	85%	99%
Total fleet -----	71%	99%

¹ This includes the three LARC, the LCM-8, the two classes of LCU, the BDL, and the CH-47 and CH-54 helicopters (which the study identified as LOTS craft) (see definition of trans-hydro craft in paragraph 13-3).

13-8. Recommended LOTS Craft

The study's initial evaluation of LOTS craft included 28 different candidates. These consisted of 8 designs that are currently in the inventory, 18 conceptual designs, and 2 commercial designs. Three of these candidates were helicopters (two that are currently in the inventory, and one—the HLH—is still in the concept stage).

After analyzing cost, performance, and other factors, six designs were selected as the preferred trans-hydro watercraft that are best suited to perform the Army LOTS mission (table 13-2). Several craft designs that are currently in the inventory were recommended for retention as part of the preferred LOTS fleet during the transition period.

Table 13-2. Recommended 1975 Transition Craft and 1985 Preferred Craft

Transition craft 1975-80	Preferred craft 1980-85
<i>Amphibian craft:</i>	<i>Amphibian craft:</i>
25-30 STON ACV	25-30 STON ACV
LARC-LX	60-STON wheeled hydrofoil
<i>Landing craft:</i>	<i>Landing craft:</i>
LCM-8	LCM-8
LCU 1466	-----
LCU 1646	LCU 1646
336-STON beaching lighter	336-STON beaching lighter
<i>Helicopters:</i>	<i>Helicopters:</i>
CH-47C	-----
CH-54B	Heavy lift helicopter

The conclusions and recommendations pertaining to the present LOTS craft, as well as the desired operational capabilities and general description of the recommended new type of LOTS craft, are discussed below. Organizational changes that will be required as the result of these recommendations are briefly described in paragraph 13-10.

- It was recommended that the LARC-V be eliminated because of its small payload, limited stability, slow water speed, and inability to transport an 8×8×20-foot container.

- It was recommended that the LARC-LX be replaced by a 60-short-ton (STON) capacity wheeled hydrofoil. The LARC-LX is more cost effective than the hydrofoil for transport of noncontainerized cargo; however, the hydrofoil is more cost effective for containers.

- It was recommended that no additional LARC-XV or LARC-LX be procured and that these craft be phased out of the Army as their recommended replacements—the air cushion vehicle and the wheeled hydrofoil, respectively—become available.

As a result of the above recommendations, two 30-

STON prototype lighters, air cushion vehicles (LACV-30), are presently being procured for the Army. The LACV-30 (fig 13-1) is 76 feet long and 37 feet wide, with a cargo space (51×33 feet) that is capable of holding three 20-foot MILVAN or SEAVAN. The LACV, which moves on a 4-foot cushion of air, is considered to be capable of carrying a 30-STON payload through an 8-foot surf. It can cross reefs, underwater obstructions, beaches, and rivers. It can also travel on ice, snow, tundra, and marshy terrain. A 60-STON-capacity hydrofoil (fig 13-2) is recommended as the replacement for the LARC-LX. In order to obtain the Army's required operational capabilities for the craft, future research and development effort will be required. The desired capabilities include ability to transport four 20-foot MILVAN/SEAVAN, a hydraulically controlled bow and stern ramp to provide a drivethrough capability, a cargo self-unloading and self-loading capability, retractable wheels, and a maximum water speed of 35 knots with a 60-STON load.

The study recognized that replacement of the LARC with the larger amphibians (LACV and hydrofoil) will require that in-transit storage areas and container marshaling areas be located closer to the beach area in order to reduce the inland travel distance.

- The LCM-8 and the new 1646 class LCU (fig 13-3) that is currently being procured to replace the 1466 class LCU were recommended for retention in the fleet. This recommendation is based on their cost effectiveness in handling noncontainerized cargo, particularly vehicles. The LCM-8 does not have the capacity, seaworthiness, or beaching capability of the LCU; however, it is lower in cost, more versatile, and more easily transported overseas.

- The largest of the recommended trans-hydro craft is the 336-STON-capacity beaching lighter (fig 13-4) which, like the hydrofoil, is still in the concept stage. When it is available, it will replace the present beach discharge lighter (BDL) and the proposed Mark II design BDL. The recommended beaching lighter does not compete with the smaller landing craft on a cost effectiveness basis; however, it does satisfy the requirement for ship-to-shore lighterage of outsize and heavyweight cargo in LOTS operations. Also, its size and capabilities will enable it to perform the coastal requirements of the CHI mission. The operational requirements of the vessel include two organic container handling cranes, a roll-on/roll-off capability, and the capability for transporting twenty-two 20-foot containers.

- In addition to the watercraft-related recommendations, the study also recommended that helicopters be used to supplement watercraft when required to discharge containers in LOTS operations and that this role be adopted as doctrine in appropriate publications.

13-9. Recommended CHI Craft

The CHI portion of the Army's service support mission is presently being accomplished by tugs, barges, passenger and utility boats, and FS-type coastal vessels. The Trans-Hydro Craft Study recognizes that there will continue to be a requirement for each of these types of craft, except the FS vessels. However, the study recommends reducing the 71 designs (table 13-3) of these craft that are presently in the fleet to eight; that is, a single design for each type of vessel. This reduction in designs will greatly simplify maintenance and will reduce the requirement for stockage of repair parts. General characteristics of the recommended coastal vessel (336-STON beaching lighter) were described in the previous paragraph; the other seven types of CHI craft are listed in table 13-3 and discussed below.

- Through the Military Sealift Command provides tugs for ocean tows and for some coastal tows, it cannot be expected to provide towing service for the Army's day-to-day harbor, coastal, and inland waterway requirements. These requirements include towing barges, retrieving disabled craft, moving floating cranes and piers, and in some circumstances assisting in berthing oceangoing ships. The vessel recommended for these services is a large self-deployable tug with a power rating of from 2,000 to 3,000 horsepower. It will replace the five large tug (LT) designs currently in the inventory.

- It is recommended that the eight designs of small tugs that are presently in the inventory be replaced with a small, easily transported, 800-900 horsepower harbor tug, capable of providing limited towing service in sheltered waters.

- Barges represent the largest recommended reduction in designs. The study recommends 4 new cargo barge designs to replace the 23 designs now in use; 3 of the recommended designs are single-hull type barges measuring 110 to 120 feet in length. These monohull designs are for dry, liquid, and refrigerated cargo. The fourth design is a modular (knockdown) type dry cargo barge which can be disassembled for rapid deployment.

- The present passenger and utility boats (J, Q, and T) are recommended replaced by a small harbor service boat with a capacity of approximately 15 passengers or 3,000 pounds of cargo. It will be used to provide general harbor utility, passenger ferry service, command and control, and harbor security and inspection service.

- The design characteristics of the present FS vessel and Y tanker limits their use to CHI missions. The recommended replacement for these vessels—the

Table 13-3. US Army CHI Craft Recommended To Replace the Present Fleet

Present craft	Preferred craft
<i>Tug boats:</i>	<i>Tug boats:</i>
LT (5)	LT (1)
ST (8)	ST (1)
<i>Barges:</i>	<i>Barges:</i>
BC (20)	BC (3)
BK (3)	BK (1)
<i>Passenger and utility boats:</i>	<i>Passenger and utility boats:</i>
J (15)	Harbor service boat (1)
Q (4)	
T (3)	
<i>Coastal vessels:</i>	<i>Coastal vessels:</i>
FS (10)	336-STON beaching lighter (1)
Y tanker (3)	
Total: 71	Total: 8

Note. The numbers in parentheses indicate the number of design variations for each type of craft.

335-STON-capacity beaching lighter—will satisfy the LOTS as well as the CHI requirements (para 13-8 above).

13-10. Organizational Changes

Though several new company-size TOE are recommended, the study anticipates a long-range savings in personnel. This savings will be possible as the result of the reduction of the number of types and designs of craft. Not only will a reduction in operating personnel be possible, but also a reduction in cellular maintenance type teams and in direct support and general support requirements will be recognized. The TOE change requirements recommended by the study are as follows:

- A new company-size TOE will eventually be required for the LACV-30. To operate and maintain the two craft presently being procured for the Army, two provisional LACV detachments have been formed at Fort Eustis, Virginia.

- Another requirement for a company-size TOE will exist when procurement of the 60-STON amphibious hydrofoil commences.

- The present FM team from TOE 55-530, which is used to operate and maintain the beach discharge lighter (BDL), can be modified to satisfy the operational and maintenance requirements of the 336-STON beaching lighter.

- The present company-size TOE and the teams that are provided in TOE 55-530 are considered satisfactory for operation of those trans-hydro craft that are not discussed above.

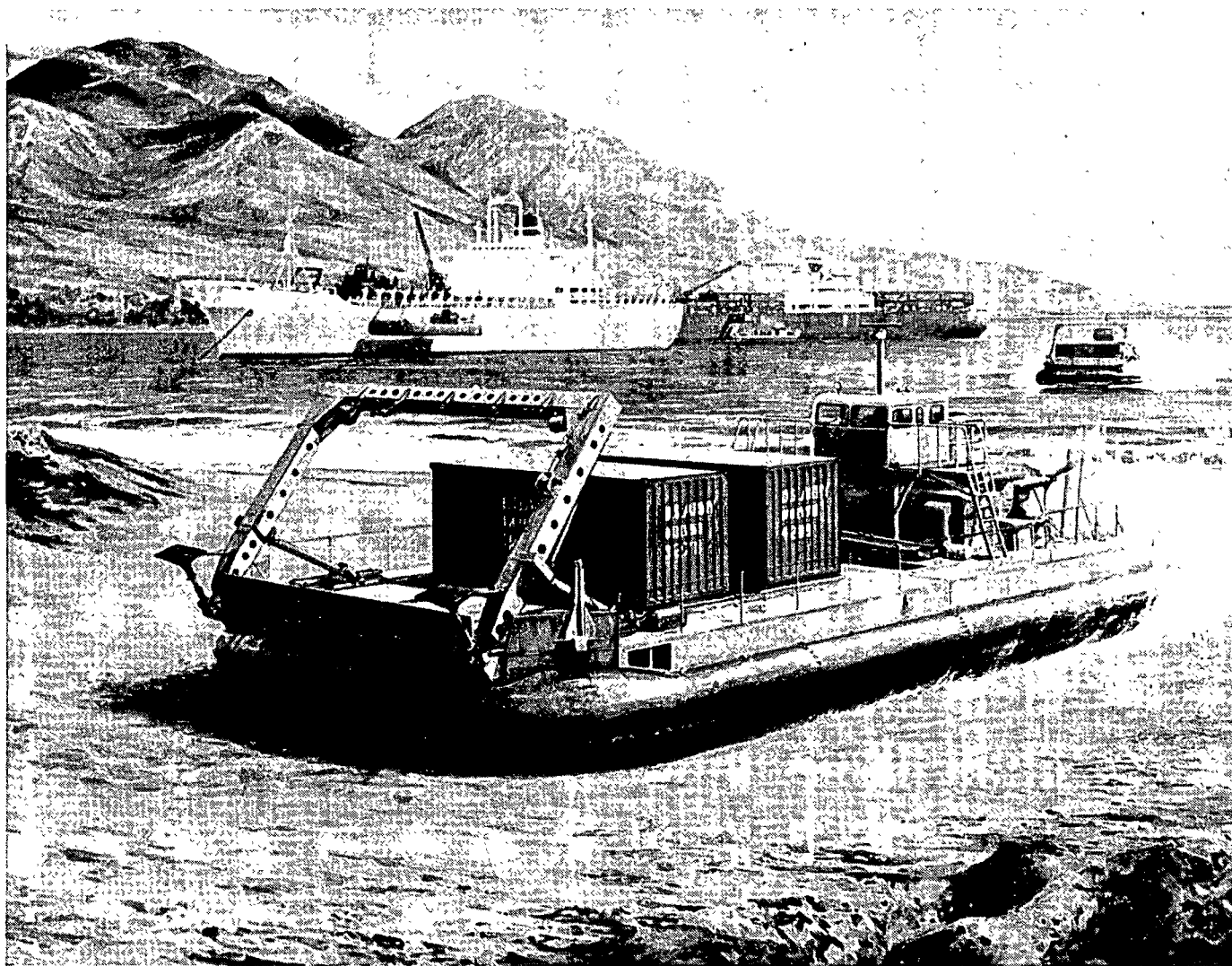


Figure 13-1. Lighter, air cushion vehicle, 30-STON capacity (LACV-30).

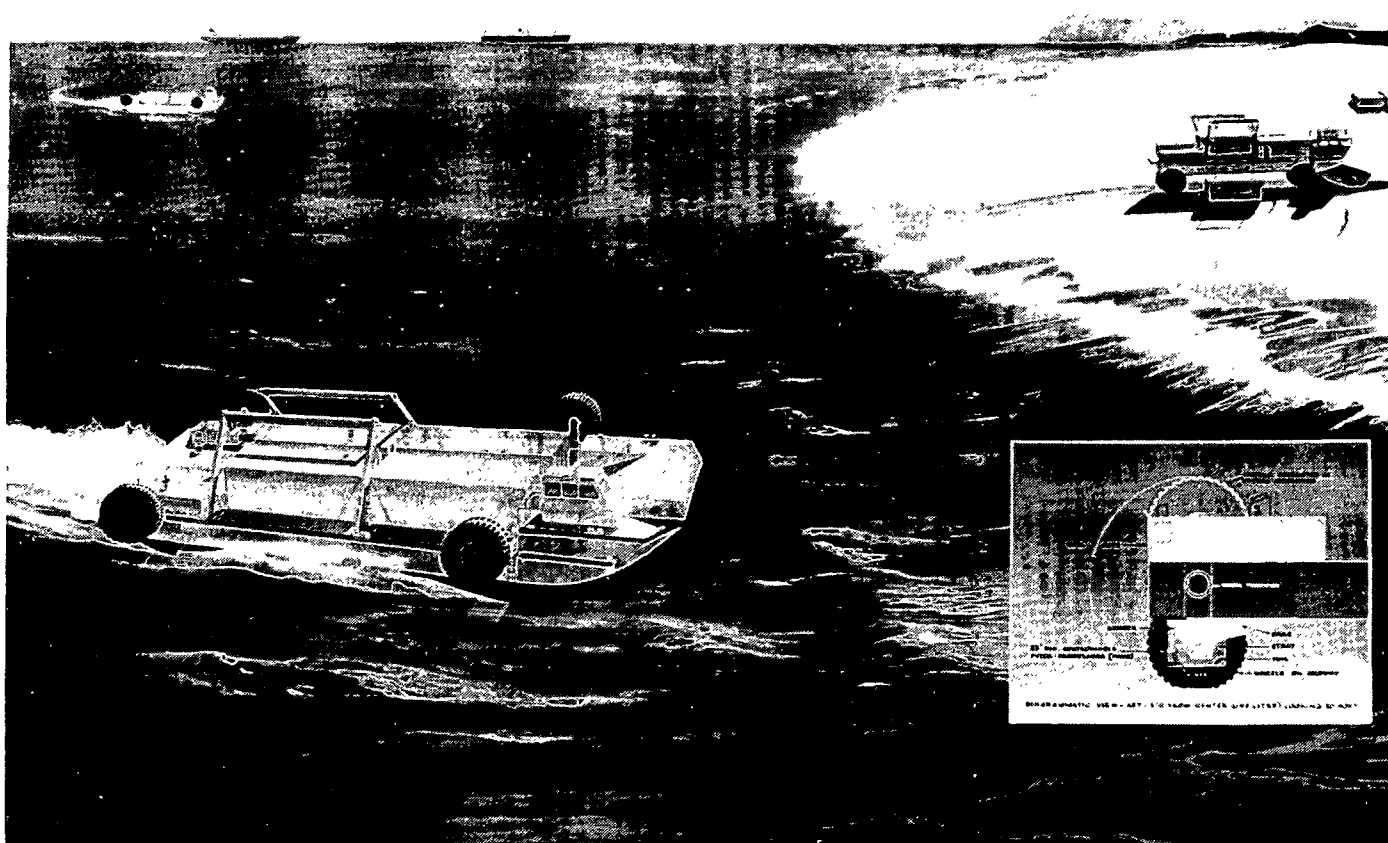


Figure 13-2. Artist's sketch of the conceptual 60-STON amphibious hydrofoil.

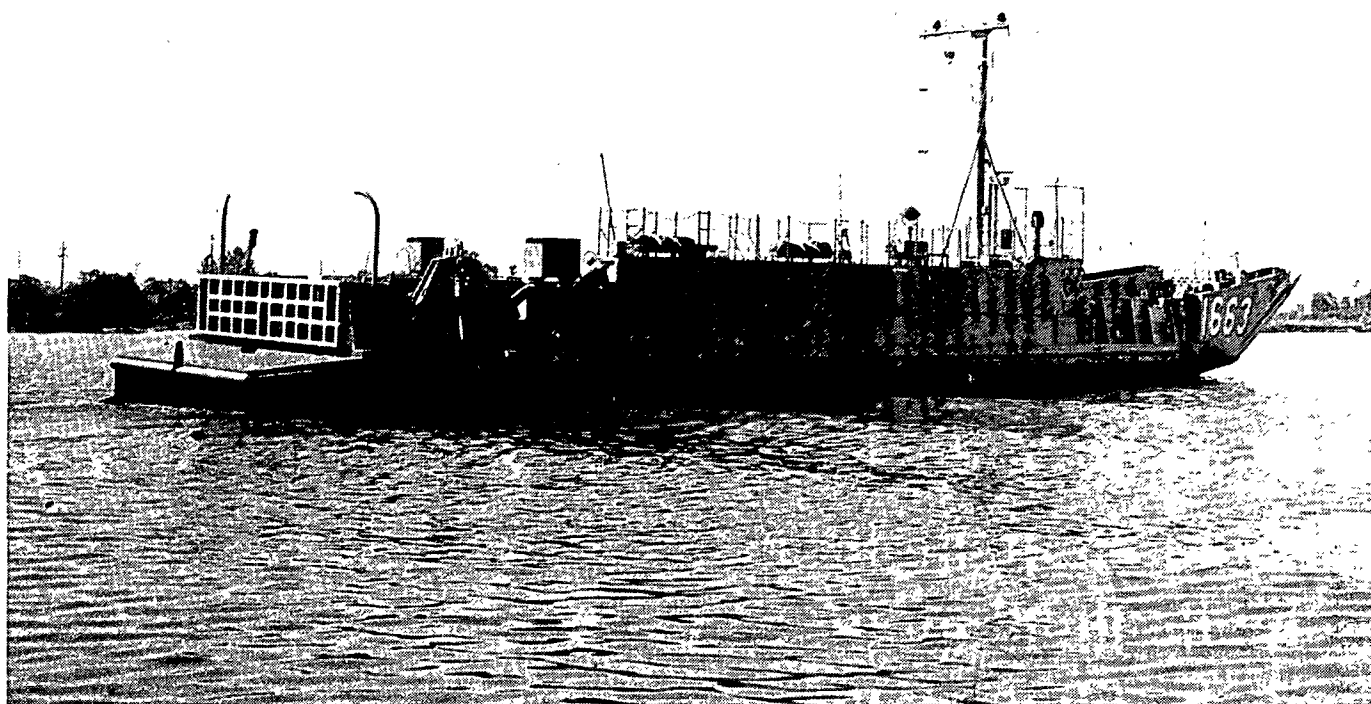


Figure 13-3. Landing craft, utility (LCU), class 1646.

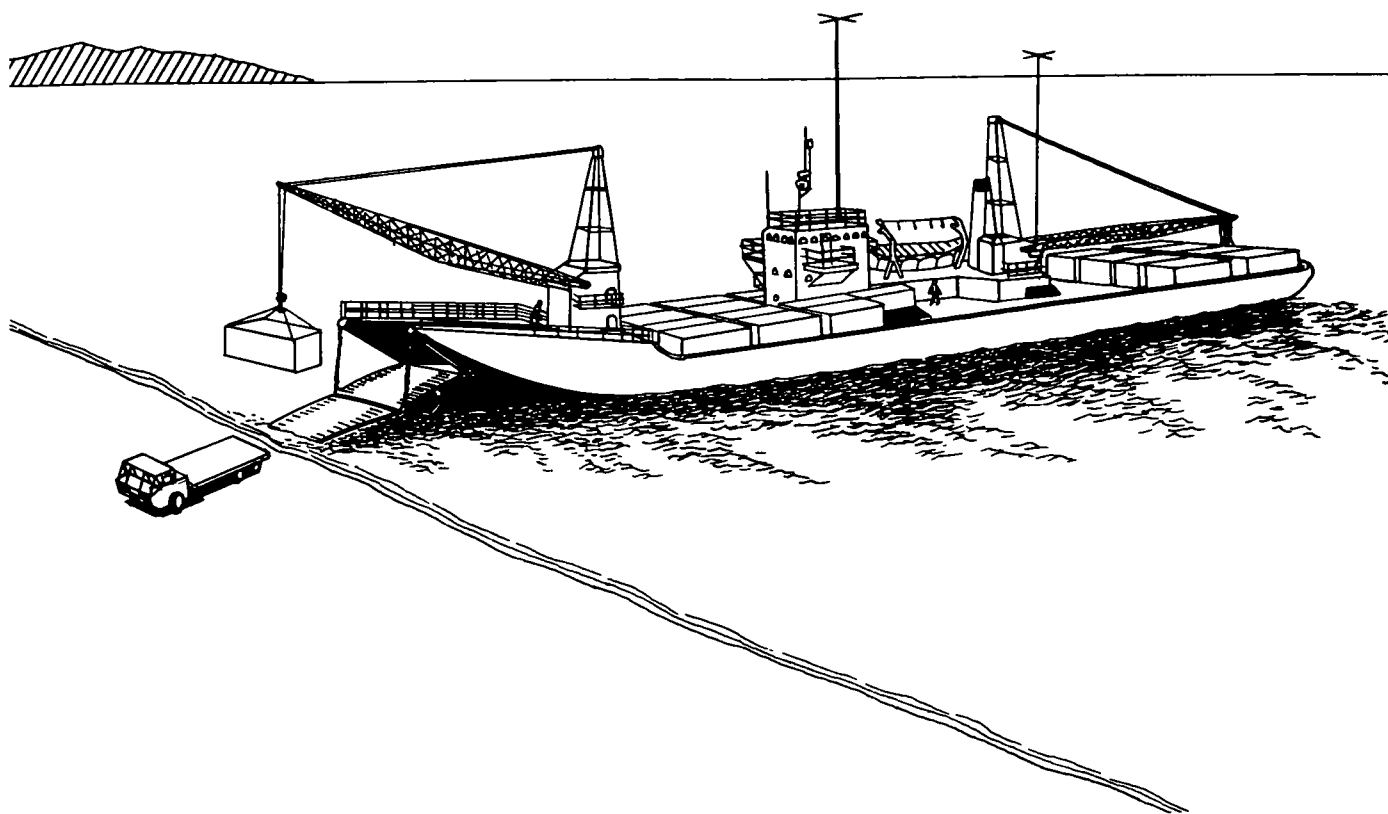


Figure 13-4. Artist's sketch of conceptual 336-STON-capacity beaching lighter.

APPENDIX A

REFERENCES

A-1. Army Regulations (AR)

55-19	Marine Casualties.
56-9	Watercraft.
310-25	Dictionary of United States Army Terms.
310-50	Authorized Abbreviations and Brevity Codes.
385-40	Accident Reporting and Records.
700-4	Logistic Assistance Program.
750-1	Army Materiel Maintenance Concepts and Policies.
750-51	Maintenance Assistance and Instruction Team (MAIT) Program.

A-2. Field Manuals (FM)

5-144	Engineer Amphibious Units.
8-35	Transportation of Sick and Wounded.
19-30	Physical Security.
20-12	Amphibious Embarkation.
21-40	Chemical, Biological, Radiological, and Nuclear Defense.
29-39	Marine Equipment Maintenance Support in the Army in the Field.
31-11	Doctrine for Amphibious Operations (NWP 22(B)/AFM 2-53/LFM 01).
31-12	Army Forces in Amphibious Operations (The Army Landing Force).
31-60	River-Crossing Operations.
31-85	Rear Area Protection (RAP) Operations.
(C)32-5	Signal Security (SIGSEC) (U).
32-6	SIGSEC Techniques.
55-1	Army Transportation Services in a Theater of Operations.
55-15	Transportation Reference Data.
55-16	Cargo Checking Handbook.
55-51	Army Water Transport Units.
55-60	Army Terminal Operations.
101-10-1	Staff Officers' Field Manual: Organizational, Technical, and Logistical Data—Unclassified Data.

A-3. Technical Manuals (TM)

55-500	Marine Equipment Characteristics and Data.
55-501	Marine Crewman's Handbook.
55-503	Marine Salvage and Hull Repair.
55-509	Marine Engineman's Handbook.
55-511	Operation of Floating Cranes.

A-4. Technical Bulletins (TB)

55-1900-202-12/1	US Army Mobility Equipment Center Floating Craft Preventive Maintenance.
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A-5. Tables of Organization and Equipment (TOE)

55-111	Headquarters and Headquarters Company, Transportation Terminal Brigade.
55-112	Headquarters and Headquarters Company, Transportation Terminal Group.
55-116	Headquarters and Headquarters Company, Transportation Terminal Battalion.
55-117	Transportation Terminal Service Company.
55-118	Transportation Terminal Transfer Company.
55-128	Transportation Medium Boat Company.
55-129	Transportation Heavy Boat Company.
55-138	Transportation Light Amphibian Company.

55-139	Transportation Medium Amphibian Company.
55-157	Transportation Floating Craft General Support Maintenance Company.
55-158	Transportation Lighterage Maintenance Company, Direct Support.
55-500	Transportation Service Organization Headquarters Units.
55-530	Transportation Watercraft Teams.
55-550	Watercraft Maintenance Teams.

A-6. Forms

DA Form 285	Accident Report.
DA Form 1208	Report of Claims Officer.
DA Form 2028	Recommended Changes to Publications and Blank Forms.
DD Form 1384	Transportation Control and Movement Document.

A-7. Department of Defense Regulation

4500.32-R	Military Standard Transportation and Movement Procedures (MILSTAMP).
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A-8. DA Pamphlets of the 310-series, Publication Indexes.

A-9. Standardization Agreements (STANAG)

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A-10. Other Publications

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By Order of the Secretary of the Army:

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